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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service • National Center for Health Statistics • Series 2, No. 89

Annotated Bibliography of Cause-of-Death Validation Studies: 1958-1980

Data Evaluation and Methods Research
Series 2, No. 89

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SUGGESTED CITATION

National Center for Health Statistics, A. Gittelsohn and P. Royston: Annotated bibliography of cause-of-death validation studies, 1958-80. *Vital and Health Statistics*, Series 2, No. 89. DHHS Pub. No. (PHS) 82-1363. Public Health Service, Washington. U.S. Government Printing Office, September, 1982.

Library of Congress Cataloging in Publication Data

Gittelsohn, Alan M.

Annotated bibliography of cause-of death validation studies, 1958-1979.

(Vital and health statistics, Series 2, Data evaluation and methods research; no. 89) (DHHS publication; no (PHS) 81-1388)

Authors: Alan Gittelsohn, Patricia N. Royston.

1. Death—Causes—Statistics—Bibliography. 2. Death—Causes—Classification—Bibliography. 3. Death—Proof and certification—Bibliography. 5. Errors, Theory of—Bibliography. I. Royston, Patricia N. II. National Center for Health Statistics (U.S.) III. Series. IV Series: DHHS publication; no. (PHS) 81-1388.

[DNLM: 1. Death certificates—Bibliograph. 2. Mortality—United States—Bibliography. 3. Diagnostic errors—Bibliography.

W2 A N148vk no. 89)

RA409.U45 no. 89 [Z5725] 312.0723s 81-10855

[RA405.A1]

ISBN 0-8406-0236-7

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

VITAL & HEALTH STATISTICS

Annotated Bibliography of Cause-of-Death Validation Studies: 1958-1980

An annotated bibliography of studies relating to the errors in diagnosing, recording, coding, and tabulating cause of death.

Data Evaluation and Methods Research
Series 2, No. 89

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U. S. GOVT. PUBS.
DEPOSITORY 376

DHHS Publication No. (PHS) 82-1363

U.S. Department of Health and Human Services
Public Health Service
Office of Health Research, Statistics, and Technology
National Center for Health Statistics
Hyattsville, Md
September, 1982

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Foreword

Compilation of national cause-of-death statistics is a basic program responsibility of the National Center for Health Statistics. Consequently, the Center is very interested in the quality of the medical certifications reported on death certificates since it is of fundamental importance in interpreting cause-of-death statistics. The more that is known about the quality of the medical certifications, the better the Center and its data consumers will be able to use national cause-of-death statistics.

This bibliography presents an annotated listing of published and unpublished papers on the quality of cause-of-death statistics. The compilation is based on a search of the relevant literature, as well as a survey of producers and users of mortality statistics. It contains 128 references to a wide assortment of studies that were conducted in this country and abroad during the preceding 24 years. Since the deaths covered by the referenced studies vary considerably by cause, place, and year of death, as well as by the methods used to evaluate the certifications, this publication contains several indexes to assist the readers in locating appropriate references. These indexes are described in the Introduction.

The bibliography was compiled intially to assist the Center in assessing the state of knowledge with respect to the quality of medical certification, and the state of the art with respect to methods that have been used to evaluate the quality of cause-of-death statistics. It is being published to provide health researchers with a comprehensive reference guide to the literature on this subject.

Definitive conclusions about the quality of medical certification on the death certificates have not been reached based on the studies listed in this bibliography. Evidently the quality varies greatly by cause of death and characteristics of the decedent. However, the findings provide no basis for complacency. Some studies detected large discrepancies between the diagnoses certified on death certificates and those reported by autopsy and hospital records. The most striking finding is that so little is known about the quality of medical certification and its effect on diagnostic statistics in general and on national cause-of-death statistics in particular.

Apparently no country has a well-defined program for systematically assessing the quality of medical certifications being reported on death certificates or for measuring the error effects on the levels and trends of cause-of-death statistics. There are, for example, only three references in this bibliography to U.S. studies that were national in scope. These studies were based on deaths due to lung cancer [44], cardiovascular diseases [83], and chronic respiratory diseases [73], that occurred during 1958, 1960, and 1963, respectively. Expanding these national studies to include other diagnoses and updating them periodically would be tremendously useful in interpreting differentials and trends in national cause-of-death statistics.

The studies that are referenced in this bibliography used a variety of methods to evaluate the quality of medical certifications on death records. The three national studies noted above, for example, were based on death record follow-back surveys of the medical providers who had certified the causes of death or had formerly treated the decedents. It may be of interest to summarize the principal design features of these follow-back surveys:

- The scope of a survey is limited to particular cause(s) of death.
- Disease algorithms are developed that specify the criteria for evaluating the certitude of diagnosis for the causes reported on the death certificate.
- Survey questionnaires are designed to collect the information required by the disease algorithms.
- Samples of deaths certified to particular causes of death are selected from the Current Mortality Sample, which is a 10 percent national sample of

death records that is processed on an accelerated schedule.

- Surveys are conducted with the medical certifiers and other medical providers that treated the sample decedents.
- Clinicians with specialties in the particular diseases work closely with the support staff that assesses the medical information reported in the survey.

The studies referred to above have demonstrated that these procedures are well suited to evaluate the causes of death that are reported on the death certificate. The methodology would have to be expanded, however, to detect the causes which should have been, but were not reported on the death certificates. Estimating the false negatives requires a complimentary type of follow-back survey that is based on a representative sample of death records that did not certify the particular causes of death under investigation. Both types of follow-back surveys are essential in the evaluation of the quality of medical certifications.

Many persons contributed to the preparation of this bibliography. The literature search and initial drafts of the annotations were performed primarily by Bruce Thompson, a graduate student at Johns Hopkins University, working under the direction of Dr. Alan Gittelsohn. Dr. Helen Abbey, Johns Hopkins University, also contributed to this work. Dr. Iwao M. Moriyama and Ms. Lillian Guralnick served as peer reviewers of this report, and they provided additional references as well as helpful suggestions. All of these contributions are gratefully acknowledged.

Monroe G. Sirken

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Annotated Bibliography of Cause-of-Death Validation Studies

Alan Gittelsohn, Ph.D., Johns Hopkins University, and
Patricia N. Royston, National Center for Health Statistics

Introduction

This bibliography contains annotations for 128 articles pertaining to the quality of cause-of-death statistics. The articles are numbered in alphabetical order by surname of the author.

Four requirements were imposed for including reports in this bibliography:

1. Reports deal with the validity of cause-of-death statements on death certificates or clinical records.
2. Reports were written in English, or English translations were available.
3. Reports were written or published after 1957.
4. Reports were based on data (as opposed to opinion).

Three sources were used in identifying relevant articles:

1. A library search for pertinent articles was initiated with the use of the Medical Literature Analysis and Retrieval System (MEDLARS) computer system. This search located articles published between 1966 and 1977 whose titles and abstracts included specified words. The following phrases and keywords were used: cause with death, death with certificate, death certificate, death adjacent statistic, correlation, precision, accuracy, accurate, difference, reliability, reliable, validity (valid). The term death certificates was entered as the main point index heading.
2. The *Index Medicus* was searched by using the same key words and phrases back to 1957 for coverage of the 23-year period—1958-80. The citation file was updated with the new entries obtained from this source.
3. Letters requesting information about relevant articles were sent to all State health department statistical offices in the Nation, to selected departments of epidemiology in medical schools and schools of public health, and to workers in vital statistics in national and international agencies. This effort added new citations, most of which were unpublished reports or reports on mortality that contain segments on reliability.

Classification system

Each article was classified and assigned corresponding codes according to (1) the data sources used, (2) the causes of death studied, (3) the country in which the deaths were registered, and (4) the latest data year. The four sets of codes assigned to each article appear in parentheses, separated by hyphens, to the right of the authors' names. The section of this Bibliography entitled "Index" lists the articles by their code categories.

The four sets of codes are described below.

1. Data sources

Codes	*Definition*
A	Autopsy reports
B	Other sources
C	Clinical records
D	Death certificates
S	Statistics

This set of codes appears first and can contain up to 4 of the letters listed. The letters indicate the materials that were analyzed in the study. In most studies the cause of death on the death certificate was compared with clinical records, autopsy reports, or both. However, a number of studies are included that do not address the quality of the certified cause of death directly but do address the question of how accurately the cause of death can be determined without an autopsy by comparing autopsy results with clinical records. Other articles are included that are based on only one of the data sources listed.

2. Cause of death

Codes	*Definition*
1	Infectious diseases
2	Cancer
3	Cardiovascular disease
4	Stroke, cerebrovascular disease
5	Respiratory disease
7	Suicide
8	Other causes
9	Combination

The cause-of-death code is a one-digit numeric code that follows the source-of-data code. Studies carrying codes 1-7 address errors in the assignment of only one disease or class of diseases as the cause of death. Code 8 indicates that the study deals with a single cause or class of causes of death other than those previously listed. Code 9 denotes that more than one cause or class of causes was studied.

3. Country

Codes	*Definition*
AU	Australia
NW	Norway
CN	Canada
CY	Ceylon
FN	Finland
IR	Ireland
IS	Israel
JP	Japan
NW	Norway
NZ	New Zealand
SW	Sweden
UK	United Kingdom
US	United States
ZZ	Several countries

The country code generally refers to the country in which the study deaths were registered. A small number of studies (coded ZZ) investigated differences in diagnostic and classification practices among several countries.

4. Latest data year

Codes	*Definition*
58-79	1958 through 1979
99	Years of data not given

The latest-data-year code appears last and denotes the latest year for which records or statistics were examined. If the article omits this information, it is coded 99.

Bibliography

1. Anonymous (D-9-ZZ-99)

The Accuracy and Comparability of Death Statistics

WHO CHRONICLE 21(1):11-17, January 1967

To investigate variations in coding practices among countries, the World Health Organization (WHO) conducted an experiment in six European countries (Czechoslovakia, Denmark, England and Wales, Finland, the Netherlands, and Sweden) in which a sample of 1,000 death certificates was circulated to the six countries for coding. Each of the sample death certificates gave more than one cause of death and was chosen so that the underlying cause of death was not obvious. All certificates were coded by the WHO Center for Classification of Diseases, London, according to the Seventh Revision International Classification of Diseases (ICD), 1955 and this coding was used as the standard for comparison. Variation was appreciable from country to country in the extent of agreement with WHO codes, the agreement being lowest for Czechoslovakia and highest for Finland. Preliminary findings indicated that national differences in the interpretation of the selection rules caused most of the discrepancies. This finding led to two further studies. First, 218 disputed certificates were recirculated to the six countries for reconsideration of and comments on their original code assignments. It was found that the provisions of the ICD selection rules had been ignored in a number of instances. In a further investigation, the WHO asked each country for 20 death certificates in each of nine specified categories. These certificates were then reproduced and sent to all the other countries for coding. The returned codings varied significantly. The author suggested several ways to improve the quality of mortality statistics, including multiple-cause coding, new restrictions in the Eighth Revision of the ICD, and better training in filling out and coding death certificates.

2. Anonymous (D-9-US-73)

Alabama's Coroner System as it Relates to Vital Statistics: A Report to the State Committee of Public Health

Department of Public Health, Division of Vital Statistics, Montgomery, Alabama, May 7, 1976. Unpublished.

In 1973, 14.8 percent of the 35,239 deaths in Alabama were certified by people without formal medical training (i.e., by a coroner who is not a physician). The authors noted that any differences in certifying practices between physicians and coroners would bias mortality statistics in Alabama. To determine the extent of such differences, physician-certified deaths and coroner-certified deaths were compared for 1973. The comparison indicated that more than 40.5 percent of the nonexternal causes of death certified by coroners were placed in the category of Symptoms and Ill-Defined Conditions. Physicians, on the other hand, had only 2.3 percent of their certificates in this category. The authors suggest three possible courses of action: (1) provide medical training for coroners, (2) provide the coroner with funds for medical consultation, or (3) replace the coroner system with a medical examiner system.

3. **Acheson, Roy M.; Nefzger, M. Dean; and Heyman, Albert** **(BCD-4-US-68)**

Mortality From Stroke Among U.S. Veterans in Georgia and 5 Western States: II. Quality of Death Certification and Clinical Records.

JOURNAL OF CHRONIC DISEASES 26:405-414, 1973

A previous report compared statistics on stroke mortality rates for veterans in Georgia with rates for five Western States (Colorado, Idaho, Montana, Utah, and Wyoming). To investigate reasons for the higher stroke mortality rates in Georgia, two groups of death certificates were selected for study. Death certificates of all veterans who died in the six study States between July 1, 1967, and June 30, 1968, with a certificate entry coded for cerebrovascular disease (Seventh Revision ICD, codes 330-334) composed the case group certificates; a 30 percent sample of all other deaths in the six States during the same year constituted the control group. The resulting sample sizes were 604 cases and 1,210 controls for Georgia and 560 cases and 1,644 controls for the five Western States. Information about the death, prior illnesses, and medical care was collected from several sources, including hospitals, physicians, medical examiners, funeral directors, and relatives. In the West, the autopsy rate was found to be higher, physicians signed death certificates of the case group more often and, before death, some common diagnostic tests were performed much more often.

4. **Adelstein, A. M.** **(S-8-UK-71)**

Certification of Hypothermia Deaths

BRITISH MEDICAL JOURNAL 1:482, 1973

This letter to editor describes how hypothermia deaths may be classified in one of four rubrics and how, as a symptom, it is disregarded when an acceptable cause is mentioned. One table is presented showing deaths with mention of hypothermia by ICD coded cause.

5. **Alderson, M. R. and Meade, T. W.** **(CD-9-UK-62)**

Accuracy of Diagnosis on Death Certificates Compared With That in Hospital Records

BRITISH JOURNAL OF PREVENTIVE AND SOCIAL MEDICINE 21:22-29, 1967

The hospital records and death certificates were compared for 1,216 deaths occurring in hospitals in 1962 in the county borough of Oxford, Oxfordshire (except Henley M.B. and R.D.C.), Abingdon Borough, and Abingdon Rural Area. Both the underlying cause of death (UCD) and the principal condition treated in hospital (HD) were grouped using the ICD List B codes (abbreviated list of 50 causes for tabulation of mortality). The principal condition treated was compared to the diagnosis of the underlying cause on the death certificate for the entire 1,216 cases. The UCD and HD fell in different List B groups in 39 percent of the cases studied. Associations with indefinite diagnoses, length of stay, and hospital specialties led the authors to conclude that these discrepancies were not random occurrences. To investigate these discrepancies, hospital records for a random 1-in-12 sample of the 1,216 cases were examined to see whether these data supported the diagnoses of the principal condition treated and the diagnosis on the death certificate. In the authors' opinion, only 7.2 percent of the cases had justifiable discrepancies.

6. **Anderson, Donald O.** **(CD-5-CN-65)**

Geographic Variation in Deaths due to Emphysema and Bronchitis in Canada

CANADIAN MEDICAL ASSOCIATION JOURNAL 98(5):231-241, 1968

To investigate the variation among Canadian provinces in mortality rates for selected chronic nonspecific respiratory diseases, a study was conducted with physicians in three provinces in 1965. The study sample included all death certificates

registered in British Columbia, Manitoba, and Ontario with any one of four codes (Seventh Revision ICD) listed as underlying cause, and one-third of the certificates with any of the four codes listed as a contributory cause. The four codes were Unspecified bronchitis (code 501), Other chronic bronchitis (code 502.1), Bronchitis with emphysema (code 502.0), and Emphysema without mention of bronchitis (code 527.1). As soon as possible after each death was registered, the certifying physician was queried by mail about the basis for and the certainty of the diagnosis. World Health Organization criteria for a diagnosis of Chronic bronchitis (ICD codes 501, 502.0, 502.1) were met in 79.4 percent of the cases when bronchitis was the underlying cause and in 76.0 percent of the cases when bronchitis was a contributory cause. Assignment of Pulmonary emphysema as the underlying or contributory cause of death was of acceptable validity in 85 percent of the cases, but only about 40 percent of the diagnoses were well established by pathological or high-grade physiological measures.

7. Anderson, Donald O. **(S-5-CN-60)**

Observations on the Classification and Distribution of Pulmonary Emphysema in Canada

CANADIAN MEDICAL ASSOCIATION JOURNAL 89:709-716, 1963

After a general review of epidemiologic principals relevant to mortality, the author examines chronic nonspecific pulmonary disease mortality rates by regions of the United States and Canada. Although regional differences in mortality may be due to altered etiologic factors and actual disease incidence, the author suggests that diagnostic convention may play a role. Examples of nosological inconsistencies are given, and the use of symptoms complexes for clinical prognosis rather than anatomic nomenclature is discussed.

8. Barclay, T. H. Crawford and Phillips, A. J. **(CD-2-CN-56)**

The Accuracy of Cancer Diagnosis on Death Certificates

CANCER 15:5-9, 1962

Seven thousand one hundred and forty-six deaths ascribed to cancer in Saskatchewan between 1950 and 1956 were reviewed in an attempt to confirm each cancer diagnosis. Overdiagnosis was measured as the proportion of all deaths due to cancer that were not confirmed. Underdiagnosis was measured by reviewing all death certificates with no mention of cancer and identifying these deaths that the Cancer Commission of Saskatchewan identified as having cancer. (The Cancer Commission, which operates free cancer diagnosis and treatment centers for residents, handles at least 85 percent of all cancer cases.) Cancer of stomach, lung, pancreas, large intestine, and prostate were overdiagnosed most often, while cancer of the skin and buccal cavity (including lips) were underdiagnosed most often. The authors conclude that death certificate diagnoses are insufficiently accurate to permit their use as a reliable indication of the incidence of cancer.

9. Barraclough, Brian M. **(S-7-ZZ-68)**

Differences Between National Suicide Rates

BRITISH JOURNAL OF PSYCHIATRY 122:95-96, 1973

The author presents recorded suicide rates (SR) and undetermined rates (UR) for 22 countries for 1968. With the exception of Chile, where the UR is high relative to the SR, the relative rankings of the 22 countries based on SR and SR + UR are highly correlated (rho = 0.95). The implication is that the countries differ in SR, a point the author regards as justifying inquiries to explain the differences that range from 1 per 100,000 in Malta to over 40 in West Berlin.

10. Barraclough, Brian M. **(S-7-UK-68)**

Are the Scottish and English Suicide Rates Really Different?

BRITISH JOURNAL OF PSYCHIATRY 120:267-273, 1972

The author contrasts the criteria and procedures used in Scotland with those in England and Wales for deciding what evidence is necessary to write "suicide" on the death certificate. Post mortem examination occurred in 80 percent of the cases of violent or unnatural deaths in England and Wales in comparison with 40-50 percent in Scotland. Examination of the suicide, undetermined, and accident rates in the two countries for all causes and for selected groupings of violent deaths for adults in 1968 reveals a significantly higher occurrence of the undetermined category in Scotland. Over one-third of the poisonings by liquids or solids were undetermined as to suicide or accident in Scotland as contrasted with 16 percent in England and Wales. The higher undetermined rate in Scotland, in combination with the lower post mortem rates in Scotland, suggest that differences in suicide

rates between the two countries may be an artifact of procedures and criteria.

11. Barraclough, Brian M.; Holding, Trevor; and Fayers, Peter **(AB-7-UK-70)**

Influence of Coroners' Officers and Pathologists on Suicide Verdicts

BRITISH JOURNAL OF PSYCHIATRY 128:471-474, 1976

In a Western London coroner's district, 330 cases of suicide, accidents, and open verdicts were studied to determine the effect that coroners' officers and pathologists have on suicide verdicts. All deaths resulting in an open verdict between January 1, 1969 to December 31, 1970, which were coded to the ICD codes E980-989, were included. To each of these deaths a suicide and an accidental death were matched according to age, sex, and cause of death. Analysis of these triples showed that no one pathologist or coroner's officer was associated with an excessive percentage of suicides, accidental deaths, or open verdicts, thus leading to the conclusion that these verdicts are determined by fact rather than the personal prejudices or feelings of the pathologist or the coroner's officer.

12. Bauer, Fredrick W. and Robbins, Stanley L. **(AC-2-US-65)**

An Autopsy Study of Cancer Patients: I. Accuracy of the Clinical Diagnoses (1955 to 1965), Boston City Hospital

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 221(13):1471-1474, 1972

In 1922, H. G. Wells found that of 578 autopsied patients with cancer, 36.5 percent had an incorrect diagnosis prior to death. Since then it has been generally accepted that cancer death rates are underestimates but the extent of the error has not been known. This study at Boston City Hospital was initiated after a sample of autopsies indicated that substantial errors in cancer death certificates might exist. Of the 10,977 autopsies that were performed between 1955 and 1965, 2,734 (25 percent) of the reports were found to contain a diagnosis of cancer. Of the cancer diagnoses, 60 percent confirmed the clinical diagnosis. The 40 percent of cancer autopsy reports containing errors were divided as follows: 26.2 percent had undiagnosed cancer, and 13.9 percent had incompletely diagnosed cancer. The authors stated that not all of the cancer diagnoses implied that cancer was the cause of death. Of the 2,734 cancer patients, 24 percent had nonmalignant causes of death. The authors conclusions were: (1) the largest sources of errors were in the deep organ malignancies, and (2) errors in diagnoses were not confined to those malignancies that did not influence the patients' death; in 64 percent of the undiagnosed cancer, the tumors had extended beyond the primary site, and in 45 percent, the cancer was fatal.

13. Beadenkopf, William G.; Abrams, Malcolm; Daoud, Assaad; and Marks, Renee U. **(AD-9-US-57)**

An Assessment of Certain Medical Aspects of Death Certificate Data for Epidemiologic Study of Arteriosclerotic Heart Disease

JOURNAL OF CHRONIC DISEASES 16:249-262, 1963

The population for this study consisted of 611 consecutively autopsied patients 45 years of age and over who died in the Albany Medical Center Hospital between March 1955 and September 1957. The underlying cause of death was determined by coding the death certificates according to the ICD. Of the patients who were shown at autopsy to have arteriosclerotic heart disease, 50 percent were coded to the 420 ICD rubric (thus the sensitivity is 50 percent), while 80 percent of the patients found not to have arteriosclerotic heart disease were not coded in the 420 category (thus the specificity is 80 percent). Note that the study showed how often death certificate cause of death reflected the presence of the condition, but did not measure the accuracy of the certified cause of death. The authors then used the same procedure for malignant neoplasms as cause of death. They found that the sensitivity and specificity were high for that disease category. They concluded that malignant neoplasms death certificates could be useful in epidemiologic studies involving associations. However, because of low sensitivity in arteriosclerotic heart disease diagnosis, any associations that might be found in a study involving death certificate data could be spurious.

14. Bonser, Georgiana M. and Thomas, Gretta M. **(ACD-2-UK-54)**

An Investigation of the Validity of Death Certification of Cancer of the Lung in Leeds

BRITISH JOURNAL OF CANCER 13(1):1-12, 1959

In a previous report concerning lung cancer in three regions of Britain, the authors had noted that more deaths were recorded than cases were diagnosed in hospitals around the Aberdeen-Leeds region. The possibility that sex was related to the tendency to overrecord was of particular interest. A total of 1,036 death certificates covering the years 1950-1954 were obtained from the files of the Statistics Department of the Medical Officer of Health for Leeds in which the cause of death was cancer of the trachea, pleura, lungs, or bronchi. These were matched wherever possible with hospital records, clinical notes, and autopsy records. When the certificate of death was compared with the clinical findings, 96.5 percent of the certificates that had lung cancer recorded as the cause of death were supported by clinical or autopsy findings. When the accuracy of the clinical diagnoses was questioned, 15 percent of them were in ". . .considerable doubt. . ."; however, for these cases the condition was generally confirmed at autopsy. With a hospital diagnosis of cancer of the lung, the diagnosis was compared with the cause of death coded by the Statistics Department of the Medical Office of Health for Leeds. This comparison showed a 92.5 percent agreement for the 879 hospital diagnoses of cancer.

15. Bourke, Geoffrey J. and Hall, Michael A. **(BD-9-IR-63)**

A Study of Some Certified Causes of Death and Age of the Certifying Doctor

JOURNAL OF THE IRISH MEDICAL ASSOCIATION 61(370):115-122, 1968

(Author's summary) "The study reports the results of the examination of domiciliary death certificates in the Republic of Ireland in 1963. Five mortality causes were chosen to determine whether or not a certified cause of death could be related to the age of the certifying doctor. A clear relationship exists between older doctors and deaths classified as being due to 'other myocardial degeneration' (ICD, 422) for male patients only, and 'senility without mention of psychosis' (ICD, 794) for both sexes. The results are discussed and it is suggested that the use of the latter term be abandoned. With regard to the former term it would appear that the majority of such deaths would be more appropriately classified under the heading 'arteriosclerotic heart disease including coronary disease' (ICD, 420). Further study in this field would be worthwhile, not only in Ireland but in other countries also, since accuracy of death certification has important epidemiological implications."

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16. Briggs, Robert C. **(AS-9-US-75)**

Quality of Death Certificate Diagnosis as Compared to Autopsy Findings

ARIZONA MEDICINE 32(8):617-619, 1975

The author asserts that the death certificate is not valid in any case except those for which the certifying physician has access to the autopsy report. Estimating that the U.S. autopsy rate is 20 percent, the remaining 80 percent bear low validity. The author compares his personal 20-year series of 260 autopsied patients with the United States mortality statistics. Diseases of the heart are overestimated by at least threefold; tuberculosis remains a leading cause of death. On this basis, he concludes that U.S. vital statistics on causes of death bear little relation to the actual state of affairs.

17. Britton, Mona **(AC-9-SW-71)**

Diagnostic Errors Discovered at Autopsy

ACTA MEDICA SCANDINAVICA 196(3):203-210, 1974

(Author's abstract) "It has been questioned whether routine autopsies are needed any longer for control and correction of causes of death, specially in clear-cut cases. This question was therefore studied in connection with deaths in a department of internal medicine. Among 400 consecutive deaths autopsy was performed in 383 (96 percent). Causes of death diagnosed before autopsy were compared with those established by the same clinicians after autopsy. As main cause of death the clinical diagnosis was thereby confirmed as correct in 57 percent of cases, and as erroneous in 30 percent. In the remaining 13 percent it had not been possible to make a definite diagnosis ante mortem. Fewer diagnostic errors were encountered among patients below than above 70 years of age. There were also fewer errors when clinical diagnoses had been considered fairly certain than when estimated only as probable. However, even in the case of deceased patients below 70 years of age with fairly certain diagnoses, 15 percent were revealed to be erroneous at autopsy. The main cause of death was a circulatory disorder in 67 percent of cases, and a

neoplastic in 17 percent. All other groups of diseases together accounted for the remaining 16 percent of deaths. Clinical diagnoses of neoplasms were more seldom found to be erroneous than diagnoses of other groups of diseases. Contributory causes of death were clinically underestimated. Of the disorders established as contributory after post-mortem 46 percent had been unrecognized before death. It is concluded that autopsies are still needed for control and correction of causes of death, also in 'clear-cut' cases."

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18. Britton, Mona (AC-9-SW-71)

Clinical Diagnostics: Experience From 383 Autopsied Cases

ACTA MEDICA SCANDINAVICA 196(3):211-219, 1974

(Author's abstract) "The aim of the present study was to investigate whether the experience of clinical diagnostics could still further be enriched through routine autopsies. The question was studied by comparing diagnoses made by the same clinicians before and after autopsy in 383 subjects. Clinical misinterpretations thereby revealed were further analysed and described. Acute myocardial infarction (AMI) was the most common main cause of death. The diagnosis was seldom disproved when clinically considered fairly certain, but the disorder had often been missed ante mortem, especially among patients with known chronic ischemic heart disease (IHD). Hidden behind this latter label were also cases with valvular lesions or with lung disorders and right heart failure. Apart from chronic IHD, cerebrovascular diseases were clinically overdiagnosed as main cause of death; sometimes recent myocardial infarcts or malignant neoplasms were instead disclosed at autopsy. Clinical diagnoses of neoplastic disorders were seldom found to be erroneous, but malignancy should be more often considered clinically. In several cases where it had been impossible to establish a definite diagnosis on clinical grounds acute abdominal disorders were revealed post mortem. An increased suspicion as regards these diseases seems warranted in obscure cases. The misinterpretations were frequently a consequence of our tendency to stick to earlier diagnoses and to overlook the development of new signs and symptoms. The same mechanism might partly explain why disorders contributing to death had often been unrecognized clinically—most frequently pulmonary embolism, AMI, cirrhosis of liver, and ulcer of stomach or duodenum. It is concluded that the Latin epigram regarding autopsies is still valid: 'Mortui vivos docent', let the dead teach the living."

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19. Burch, Thomas A. (BCD-9-US-73)

Hawaii Mortality Followback Study: I. Introduction

HAWAII STATE DEPARTMENT, R AND S REPORT ISSUE NO. 16, RESEARCH AND STATISTICS OFFICE, 1977

This paper is a preliminary report on the design of the Hawaii followback study, which explored the possibility of collecting information on the extent of disability and the level of health care services received during the year preceding death. The author presents the questionnaires that were sent to physicians, hospitals, and informants. Selection criteria for the sample are specified, and tables are presented to indicate characteristics of the sample population. For the results and conclusions of the study, see No. 113 in this report.

20. Burrows, Stanley (AC-9-US-73)

The Postmortem Examination: Scientific Necessity or Folly?

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 233(5):441-443, 1975

To study whether recent advances in diagnostic techniques have lessened the need for time-consuming, expensive autopsies, postmortem findings were compared with clinical diagnoses for 252 adults who died while inpatients at Cooper Hospital in Camden, New Jersey. The major postmortem findings essentially agreed with the clinical diagnoses in 88 percent of the cases, with no significant differences by sex, age, or length of hospitalization. Of the 30 cases in which the postmortem findings differed substantially from the clinical diagnosis, a change of therapy would have been effective for about one-third. The autopsies were most productive in the cases of older adults hospitalized one day or less and patients with clinical problems involving the kidney, liver, gastrointestinal system, central nervous system, or of uncertain nature. This indicates that cases should be selected carefully for autopsy, to avoid unnecessary expense.

21. Carter, Ann P. and Lee, John A. H. **(DS-2-US-67)**

Death Certification of Malignant Melanoma: A Problem in Epidemiology

AMERICAN JOURNAL OF EPIDEMIOLOGY 93(2): 77-78, 1971

For malignant melanoma from 1958 to 1967, the percent of deaths with primary site coded as unknown varied from 61 percent to 71 percent in the United States. This variation is in contrast to that of other skin cancer deaths in the United States during the same period of time, where the primary site was unknown in only 18-28 percent. In England and Wales from 1958 to 1967, 11-21 percent of melanoma deaths were coded as unknown primary site, and only 1-8 percent of the primary sites were unknown for other skin cancers, even though the same ICD classification was used.

The authors suggest that the proportion of melanomas coded as unknown primary site could be reduced by adopting the procedure used successfully in England and Wales, where a followup postcard is mailed to the certifier when more detailed information is needed.

22. Carucci, Peter M. **(CD-9-US-72)**

Reliability of Statistical and Medical Information Reported on Birth and Death Certificates

NEW YORK STATE DEPARTMENT OF HEALTH MONOGRAPH NO. 15, 1979

In a study of the reliability of death certificates, 2,480 hospital records for patients discharged dead in 1972 were microfilmed in 96 upstate New York hospitals. The reliability of the cause-of-death statements were measured in terms of agreement with the hospital records. Agreement on underlying cause of death between the two sources at the following ICDA code levels—four digit, three digit, the disease category, and the major disease category—were 66, 74, 84, and 94 percent, respectively. Percent agreement at the disease category level is also shown for each disease category. Agreement at the disease category level for malignant neoplasms and cardiovascular-renal disease were 92 and 84 percent, respectively. The author concludes that information from death certificates agreed well with information from hospital records. A parallel study on the quality of birth certificate information was conducted simultaneously and is discussed thoroughly in this article.

23. Clarke, Cyril and Whitfield, A. G. W. **(CD-8-UK-77)**

Deaths From Rhesus Haemolytic Disease in England and Wales in 1977: Accuracy of Records and Assessment of Anti-D Prophylaxis

BRITISH MEDICAL JOURNAL 1(6179):1665-1669, 1979

Eight years after prophylactic anti-D gammaglobulin became generally available to prevent immunization of rhesus-negative women, deaths still occurred from haemolytic disease of the newborn (HDN). To investigate the circumstances in which these deaths occurred, copies of death certificates were obtained for all deaths that occurred in 1977 in which HDN was listed as a cause of death (54 liveborn cases and 101 stillbirths). The causes of death listed on the certificates were compared with causes determined from a study of clinical records obtained from hospitals and obstetricians who had provided care. Overreporting of haemolytic disease occurred in about one-fourth of the liveborn cases because cases due to hydrops automatically were coded to HDN under the Eighth Revision of the ICD. HDN was underreported as the underlying cause of death in the liveborn cases because it was incorrectly recorded as a contributory cause on the death certificates. Among the 101 stillbirths, 31 were found to be due to a cause other than HDN. These errors in cause of death statistics create an inaccurate picture of the efficacy of anti-D prophylaxis.

24. Cooper, Edward S.; Cooper, Jean W.; and Schnabel, Truman G., Jr. **(ACD-1-US-63)**

Pitfalls in the Diagnosis of Bacterial Endocarditis. A Review of 159 Patients, with Emphasis on 96 With Autopsy

ARCHIVES OF INTERNAL MEDICINE 118:55-61, 1966

The report reviews associated clinical findings in 159 patients with bacterial endocarditis at the Philadelphia General Hospital between 1954 and 1963. Of the 96 patients autopsied, 28 (29 percent) were correctly diagnosed ante mortem. Of the clinically unrecognized, approximately one-half had endocarditis as a complication of an associated disease. Case reports are presented to illustrate difficulties in diagnosis, and blood culture results are discussed.

25. Davis, Joseph H. **(AC-8-US-64)**

Medical Examiner Problems Arising From Neurosurgical Cases

CLINICAL NEUROSURGERY 12:300-311, 1964

The author discusses the problems of clinically diagnosing intracranial hematomas, poisoning in the presence of head trauma, problems of alcohol, and certain other neurological causes of death. Several case studies are presented.

26. Dean, Geoffrey **(DS-9-IR-66)**

The Need for Accurate Certification of the Cause of Death and for More Autopsies

JOURNAL OF THE IRISH MEDICAL ASSOCIATION 62(386):273-278, 1969

In carrying out a study of lung cancer and bronchitis in the Republic of Ireland, the author encounters serious deficiencies in the system for certifying cause of death in the Republic of Ireland. He cites several examples of incorrect certification procedures and recommends specific changes in the system to improve the accuracy of the certified cause of death. A brief discussion of recent mortality trends is also included.

27. de Faire, Ulf;
Friberg, Lars;
Lorich, Ulla; and
Lundman, Torbjörn **(CD-9-SW-73)**

A Validation of Cause-of-Death Certification in 1156 Deaths

ACTA MEDICA SCANDINAVICA 200:223-228, 1976

(Author's abstract) "Swedish twins have been followed for mortality since 1961, when the Swedish Twin Registry was formed. During the years 1961-73 there were 1,290 deaths among twins born in 1901-25. In 1,156 cases the cause of death could be established from collected records and classified according to the 1965 Revision of ICD. Using the review of records as the standard, rates of detection and confirmation relating to the death certificate diagnoses were calculated. It is concluded that Swedish death certificate data are fairly valid for use in epidemiological studies and mortality statistics with regard to most cancer forms, cerebrovascular disease, ischemic heart disease, bronchitis, asthma and emphysema, accidents and suicides, but not for diabetes mellitus, alcoholism, mental diseases, rheumatic heart diseases and other heart diseases. However, in selected clinical-epidemiological studies it is often necessary to collect all available documents prior to judging the cause of death."

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28. Dorn, Harold F. and
Cutler, Sidney J. **(CD-2-US-47)**

Comparison of Death Certificates and Case Reports

PUBLIC HEALTH MONOGRAPH NO. 56: Morbidity From Cancer In the United States, pp. 117-124. 1958.

In 1938 the National Cancer Institute initiated a series of cancer morbidity surveys in 10 metropolitan areas, representing different geographic regions of the United States. These same areas were resurveyed in 1947 and 1948. The resurvey covered approximately 10 percent of the total and 15 percent of the urban population of the United States. Data were collected from every physician, hospital, and clinic in the survey areas on every cancer patient diagnosed, observed, or treated during the 1947 calendar year.

In addition, the records of local vital statistics offices were searched for information on deaths from cancer as a partial check upon the completeness of reporting. The primary purpose of the study was to estimate incidence, prevalence, and mortality rates for cancer. However, the study data permitted an evaluation of the validity of the cause of death entered on the death certificate. The primary site of cancer from the case report and the underlying cause of death from the death certificate were compared for each resident cancer patient reported as dying during the survey year or 6 months thereafter. The study group included 22,681 cancer cases. Detailed tables are presented showing agreement between the two records by primary site. Overall, 82 percent showed the same major site group, with the best agreement for leukemia (95 percent) and the digestive system (90 percent) and the poorest agreement for other and unspecified sites (33 percent) and soft tissue (42 percent). Survey results are compared for the 1947 and 1937 studies, showing little overall change in agreement in the major site group, but significant improvement for certain sites (respiratory system, skin, brain, and bone).

29. Ehrlich, Dov; Li-Sit, Marcel; and Modan, Baruch (AD-2-IS-69)

Some Factors Affecting the Accuracy of Cancer Diagnosis

JOURNAL OF CHRONIC DISEASES 28:359-364, 1975

From January 1, 1968 to December 31, 1969, 1,212 consecutive autopsy records of patients who died at the Chaim Sheba Medical Center, Tel Hashomer were screened. These represented 49 percent of the deaths in this hospital during the 2 year period. Subsequently, records of all cases with a diagnosis of a malignant neoplasm on either the post-autopsy record, or on the preautopsy request were selected and comprehensively reviewed. The cases were divided into three categories: (1) confirmed positives (226 cases), (2) false positives (43 cases), and (3) false negatives (28 cases). An advanced age, non-European ethnic origin, short length of terminal hospitalization, and lower rate of performance of laboratory tests were each found to be of major importance in misdiagnosis.

30. Engel, Linda W.; Strauchen, James A.; Chiazze, Leonard, Jr.; and Heid, Marian (ACD-9-US-70)

Accuracy of Death Certification in an Autopsied Population With Specific Attention to Malignant Neoplasms and Vascular Diseases

AMERICAN JOURNAL OF EPIDEMIOLOGY 111 (1): 99-112, 1980

(Author's abstract) "Accuracy of certification of underlying cause of death and implications for US mortality statistics were assessed among 257 autopsied cases collected during the calendar year 1970 at a shortstay general hospital in Atlanta, GA. Clinicopathologic cause of death (CPCD) certificates, with assignment of underlying cause of death based on autopsy findings in combination with pertinent clinical data, were prepared by a pathologist and were employed as a standard of comparison against which the accuracy of the underlying cause of death on the original death certificate was measured. Results suggest that autopsy findings are not necessarily used to supplement clinical data in filling out death certificates. Improper recording of underlying cause of death was found in 42 percent of the autopsied cases. Malignant neoplasms were found to be underreported and vascular diseases overreported, each by approximately 10 percent, when original certificates were compared to CPCD certificates The confirmation rate for original death certificate diagnoses was 89 percent. In the case of a confirmed diagnosis, the underlying cause of death was substantiated by postmortem findings as having existed regardless of its role in the sequence of events leading to death. The underlying cause of death as assigned by the pathologist was listed on the original death certificate among the sequence of events leading to or contributing to death at the rate of 72 percent (i.e., this rate measures the sensitivity of the death certificate)."

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31. Erhardt, Carl L.; Weiner, Louis; and McAvoy, Grace (AD-9-US-56)

Pathological Reports for Mortality Statistics

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 171(1):119-122, 1959

Since 1945, New York City has required that autopsy reports be submitted to the vital statistics office to revise the original cause of death. However, a 1955 study showed poor compliance with this requirement. To determine whether the requirement should be enforced, a study was made of autopsy reports submitted in 1956, when special requests to hospitals resulted in almost twice as many autopsy reports (5,217) being filed as in 1955. Cause-of-death codes based on autopsy reports were compared with original coded causes, and tallies were made of cases in which assignment to another cause group was indicated by the autopsy report. A review of the 13 cause groups in which 20 or more changes were indicated showed that, numerically and proportionately, the changes between groups were small; only 15.2 percent of the reports indicated any change in the causes of death. The authors concluded that the expenditure in time, money, and effort to fulfill the requirement was not justified by the small improvement in the accuracy of the mortality statistics.

32. **Fedrick, Jean and Butler, N. R.** (ACD-9-UK-58)

Accuracy of Registered Causes of Neonatal Deaths in 1958

BRITISH JOURNAL OF PREVENTIVE AND SOCIAL MEDICINE 26:101-105, 1972

The 1958 British Perinatal Mortality Survey (BPMS) included a detailed study of the causes of 1,656 neonatal deaths that occurred in England, Scotland, and Wales during March, April, and May 1958. To investigate the shortcomings of the Seventh Revision of the ICD, causes ascribed by the BPMS were compared with causes coded by the General Register Office and with causes entered on death certificates. Anencephalus and rhesus isoimmunization were coded most accurately (89 percent); the greatest discrepancies were found for major renal malformations and pulmonary lesions. Even obvious congenital malformations such as spina bifida were found to be coded to other causes. Errors were attributed to the coding system and to the inattention of physicians completing death certificates.

33. **Florey, Charles Du V.; Senter, Margaret G.; and Acheson, Roy M.** (DS-4-US-64)

A Study of the Validity of the Diagnosis of Stroke in Mortality Data 1. Certificate Analysis

THE YALE JOURNAL OF BIOLOGY & MEDICINE 40(2):148-163, 1967

A study was made of all death certificates of New Haven residents over 15 years of age who died during 1959-64 with cerebrovascular accidents (CVA) listed on the certificates as underlying (Group 1) or contributory (Group 2) causes of death. All causes of death listed on the certificates were coded by the authors, and the codes were compared with the underlying cause of death codes originally assigned by coders for published national mortality statistics. Of the 1,038 certificates in Group 1, only 10 CVA codes assigned by the authors differed from the original codes—seven were Health Department coding errors, and three were differences in opinion as to the most important cerebral event among several mentioned on the certificate. More vague CVA codes were assigned as contributory causes of death than as underlying causes, because coders generally selected more precise diagnoses as underlying causes. Some biases to which certain CVA diagnoses were subject also were noted.

34. **Florey, Charles Du V.; Senter, Margaret G.; and Acheson, Roy M.** (ACD-4-US-64)

A Study of the Validity of the Diagnosis of Stroke in Mortality Data II. Comparison by Computer of Autopsy and Clinical Records with Death Certificates

AMERICAN JOURNAL OF EPIDEMIOLOGY 89(1): 15-24, 1969

(Author's abstract) "Clinical records of residents of New Haven, Connecticut, who died from cerebrovascular disease between 1962-1964 were abstracted for data concerning the final strokes. Of 690 possible records, 620 were abstracted. The method by which the records were reviewed by computer is described in detail along with the criteria for diagnosis of the different types of strokes. The diagnoses for each decedent found in the autopsy report, clinical record, death certificate and by computer were compared with each other and graded as to whether they were identical, similar or dissimilar. The diagnoses from the autopsies and records (133 cases) agreed in 79 percent of cases; from autopsies and certificates in 65 percent of cases; and of diagnoses from all the records abstracted and which were not for decedents who had definitely died in the absence of cerebrovascular disease (607 cases), 74 percent agreed with the certificates. The reliability of the diagnoses was graded into five categories ranging from autopsy confirmation to no evidence available. Evidence from autopsy diagnoses and good clinical records indicated that cerebral hemorrhage was over-diagnosed on death certificates at the expense of thromboembolism. The hemorrhage-thrombosis ratio from certificate data was 2.7:1 and from autopsy and clinical data .78:1."

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35. **Garcia-Palmieri, Mario R.; Feliberti, Manuel; Costas, Raúl Jr.; Benson, Herbert; Blanton, James H.; and Aixala, Ramón** (ABCD-3-US-63)

Coronary Heart Disease Mortality—A Death Certificate Study

JOURNAL OF CHRONIC DISEASES 18:1317-1323, 1965

To evaluate the apparent lower mortality from coronary heart disease (Seventh Revision of the ICD, 420) for males 45-64 years of age in Puerto Rico

compared with the United States, the authors collected diagnostic data on 674 deaths occurring between May 1, and October 31, 1963 in San Juan of persons 20-64 years of age. Autopsy and hospital records were reviewed; physician and family interviews were conducted independently and a new cause of death was chosen, recoded by routine coders, and compared with the one on the original death certificate. A net gain in death rates from coronary heart disease based on the revised cause of death statements did not explain the difference in rates in the United States and Puerto Rico. Eight tables detail the sources of data, autopsies, age and sex distribution of deaths, and corrected coronary heart disease rates for Puerto Rico and the United States.

36. Gittelsohn, Alan **(CDS-9-US-72)**

Notes on Data Quality

Cooperative Health Information Center of Vermont, Inc., Burlington, 1974. Unpublished.

The author examines questions of the reliability of health data sets by using hospital and mortality records maintained by the Cooperative Health Information Center of Vermont State Department of Health. The 94,248 patient discharge abstracts contained in the 1972 Vermont hospital file were studied to determine the frequency of occurrence of impossible code combinations. For sex and diagnosis incompatibilities, the rate was 137 errors per 100,000 entries; for sex and procedure incompatibilities, the rate was 63. Over half of the errors were accounted for by two hospitals contributing less than 20 percent of the case load.

Hospital abstracts for the years 1969-71 were also reviewed to evaluate the consistency of the final diagnosis explaining admission with the types of surgical procedures performed. For the eight types of surgery studied, the final diagnosis was consistent with the surgery performed in over 95 percent of the cases. Finally, hospital and death records were linked for 5,824 patients with discharge status of expired during 1969-71. The underlying cause of death from the death record was compared with all diagnoses coded on the hospital record, and the degree of agreement was coded on a scale of 1 (agreement at the 3-digit level of the ICDA) to 4 (no agreement). Major discrepancies between hospital and death records were found. Discrepancies were related to cause of death, size of hospital, and length of stay, but were not related to physician specialty or number of diagnoses.

37. Gittelsohn, Alan and Senning, John **(CD-9-US-75)**

Studies on the Reliability of Vital and Health Records: I. Comparison of Cause of Death and Hospital Record Diagnoses

AMERICAN JOURNAL OF PUBLIC HEALTH 69(7):680-689, 1979

(Author's abstract) "Based on computer linkage of death records and hospital discharge abstracts, underlying cause of death and discharge diagnoses are compared for 9,724 Vermont resident in-hospital deaths occurring between 1969 and 1975. The agreement between the diagnoses recorded in the two data systems provides a measure of the reproducibility of recording, abstracting, and coding practices. Using the first three digits of the International Classification of Diseases, the agreement between cause and closest medical record diagnosis was 72 percent. Concordance declined by patient age and length of hospital stay and varied significantly by coded cause of death. A major source of variation was the hospital of death where agreement levels ranged between 45 and 84 percent. The latter finding is regarded as a potential starting point for targeting investigation of sources of discrepancy and initiating efforts to improve diagnosis recording and coding in the two record systems. The value of both depends on continuing efforts to improve and maintain data quality."

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38. Goldacre, M. J. **(CD-1-UK-73)**

Accuracy of Death Certification for Acute Bacterial Meningitis

PUBLIC HEALTH, LONDON 91:279-281, 1977

Case records were collected and studied for every identifiable case of acute bacterial meningitis or meningococcal disease occurring in children under 10 years of age in the Northwest Metropolitan Region between 1969 and 1973. Of the 94 deaths identified in this search, 90 percent were coded under one of the rubrics for meningitis or meningococcal disease, while the remaining deaths were attributed to laryngotracheitis, prematurity, gastroenteritis, septicemia, bronchopneumonia, chronic lymphoid deficiency, and otitis media. The acute meningitis that had been

diagnosed in these children was not mentioned on the death certificate in six of the nine cases assigned another cause. It was found that many inaccuracies could have been avoided by recording available information on the death certificate.

39. Gorham, L. Whittington **(AC-3-US-56)**

A Study of Pulmonary Embolism. Part 1. A Clinico-pathological Investigation of 100 Cases of Massive Embolism of the Pulmonary Artery: Diagnosis by Physical Signs and Differentiation from Acute Myocardial Infarction

ARCHIVES OF INTERNAL MEDICINE 108:76-90, 1961

One hundred cases of massive pulmonary embolism were selected for study from 5,700 autopsies performed between 1934 and 1956 in New York Hospital. A review of autopsy protocols and clinical records indicated that myocardial infarction and strokes tended to be clinically diagnosed at the expense of embolization. The author describes 12 physical signs that he believes could be used to improve the accuracy of a pulmonary embolism clinical diagnosis.

40. Green, Adele and Donald, K. J. **(AD-9-AU-73)**

Necropsy As a Control of Death Certification: Some Unexpected Findings

MEDICAL JOURNAL OF AUSTRALIA 2(4):131-132, 1976

(Author's abstract) "A comparison of death certificates and necropsy findings in a group of premenopausal women suggests that a number of diseases are either underdiagnosed [or overdiagnosed] in life. Atypical cases of intracerebral haemorrhage are frequently misdiagnosed. These occur in the frontal, temporal or parietal lobes in nonhypertensive women and may be suitable for surgical treatment. Their aetiology remains obscure. Pulmonary embolus is habitually underdiagnosed in premenopausal women and myocardial infarcts appear to be overdiagnosed. The study reemphasizes that death certificates are inaccurate and that low necropsy rates render accurate statistics of diseases in the community difficult to obtain."

NOTE: The study group included all women residents of Brisbane City, Australia, between the ages of 35 and 49 who died during the years 1969 through 1973.

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41. Griffith, G. Wynne **(S-2-UK-73)**

Cancer Surveillance with Particular Reference to the Uses of Mortality Data

INTERNATIONAL JOURNAL OF EPIDEMIOLOGY 5(1):69-76, 1976

As a section of a larger report, the accuracy of cancer mortality statistics is reviewed. Citing several references and presenting a table of the percent certified cancer deaths in 12 cities before and after a review of diagnostic evidence, the author conjectures that cancer deaths may be underestimated by an average of 5 percent. On the basis of other reports, the author concludes that changes in the ICD classification of cancer deaths over the years has not resulted in any major changes in "secular trends" of cancer mortality rates. However, he did warn that as the ICD coding of cancer sites becomes specific, errors in ICD classification become more pronounced.

42. Griffith, G. Wynne and Morgan, G. A. V. **(S-9-UK-53)**

Diagnostic Precision as a Factor in Male Mortality Data

BRITISH JOURNAL OF PREVENTIVE AND SOCIAL MEDICINE 15:68-78, 1961

To investigate relationships between causes of death, a factor analysis was performed on the crude male mortality rates for 167 of the administrative areas of England and Wales for the 4-year period 1950-53. The first principal component identified in the factor analysis, which accounted for 64.3 percent of the total variance, was found to be concerned with the size of population by age. Two components that accounted for much of the remaining variance for certain causes of death were thought to be aspects of diagnostic precision. The basis for and implications of this interpretation of the two components are discussed.

43. Gwynne, J. F. **(AD-9-NZ-73)**

Death Certification in Dunedin Hospitals

Report to the Medical Research Council of New Zealand, Unpublished Report, 1976

Death certificates and autopsy protocols were compared for a study group comprised of 643 post mortem examinations performed between October 1, 1971 and September 30, 1973 in Dunedin, New

Zealand. Stillbirths, emergency room deaths, and coroner's cases were excluded. Frequency distributions of both cause-of-death categories and demographic characteristics of the study population are presented in tables. The causes of death are sorted into 17 major disease groups. Errors in diagnosing specific disorders within each group are tabulated by type of diagnostic error. The author reports that, overall, 57.5 percent of the certificate causes of death had significant errors when compared with the post mortem findings. In conclusion, he presents four recommendations for improving mortality statistics.

44. Haenszel, William; Loveland, Donald B.; and Sirken, Monroe G. **(BD-2-US-58)**

Lung-Cancer Mortality as Related to Residence and Smoking Histories. 1. White Males

JOURNAL OF THE NATIONAL CANCER INSTITUTE 28(4):947-1001, 1962

To study variations in lung cancer mortality by lifetime residence history, controlling for smoking history, a 10-percent sample was selected of all white male lung-cancer deaths in the United States during 1958. Residence and smoking histories were collected from family informants and additional diagnostic details from certifying physicians. Residence and smoking histories were also obtained for a sample of the general population from the U.S. Bureau of the Census *Current Population Survey*.

Certifying physicians were queried by mail about the methods used to establish the diagnosis, whether tissue had been microscopically examined, and the histologic type. Seventy-six percent of the 2,381 sample death certifications were based on microscopic examination of tissue, and 66 percent were based on tissue from the primary site. Most of the remaining cases (18 percent) relied on X-ray findings. The diagnosis was histologically confirmed more often for decedents under 65 and for decedents who had lived in metropolitan counties, although the differences by residence were minor.

45. Hällén, J. and Nordén, J. **(AC-8-SW-60)**

Liver Cirrhosis Unsuspected During Life: A Series of 79 Cases

JOURNAL OF CHRONIC DISEASES 17:951-958, 1964

During the 10-year period 1951-60, 360 cases of liver cirrhosis were diagnosed at Malmo General Hospital in Malmo, Sweden. Of these cases, 115 were diagnoses at necropsy and had not been suspected during life. Seventy-nine of the 115 unsuspected cases presented a histologically unequivocal picture and, therefore, were selected for further study. Clinical symptoms and abnormal laboratory findings for these cases were rare and often could be explained by coexisting diseases of the aged. Liver cirrhosis was found to be the main cause of death in 14 percent of the 79 cases.

46. Heasman, M. A. and Lipworth, L. **(ACD-9-UK-59)**

Accuracy of Certification of Cause of Death

GENERAL REGISTER OFFICE, STUDIES ON MEDICAL AND POPULATION SUBJECTS, NO. 20, Her Majesty's Stationery Office, London, 1966

This study of 9,501 deaths in 75 hospitals in England and Wales in mid-1959 was designed to estimate the effect of autopsy examinations on mortality statistics. A dummy death certificate was completed by the clinician without reference to autopsy findings, and a second one was done by the pathologist. They were compared after coding by staff of the General Register Office and complete agreement (all four digits of the Sixth Revison of ICD) was found for 45.3 percent of the deaths. The authors note that disagreements of fact (i.e., where the underlying cause on one certificate was not mentioned on the other) occurred in 25 percent. The underlying cause of death is presented by ICD categories, and estimates

of the alterations in mortality statistics are calculated. The authors acknowledge that autopsies are not unbiased or free from error as a standard for accuracy. These findings apply only to hospitalized deaths (roughly half of all deaths in England and Wales) and may have been biased toward the group of deaths posing difficulty diagnostically. The study design assumes that all clinician's certificates are completed without benefit of post mortem examination, though the authors recognize this is not the case. The authors note that extension of these results to national statistics requires knowledge of the proportion dying out of the hospital, the number autopsied, age of death, and the cause of death, since the accuracy varies greatly for these characteristics.

47. Hewitt, David; Milner, Jean; and Csima, Adele **(S-9-US-59)**

Some Proposed "Comparability Areas" for U.S. Statistics on Cause of Death

PUBLIC HEALTH REPORTS 84(10):857-863, 1969

(Author's summary) "After becoming qualified at a particular medical school, physicians do not disperse uniformly all over the United States but tend to take up practice in circumscribed regions. Because of variations in diagnostic preferences and in the medical vocabulary among medical schools, and consequently among their graduates, these geographic patterns of physician settlement can give rise to spurious differences between States in statistics on causes of death. An index is therefore proposed for measuring the degree of comparability between any pair of States, together with a method for building up 'comparability areas' in which interstate comparisons will have some assurance of validity. Fourteen comparability areas are proposed, based on the known geographic distributions of medical school alumni in 1959. All but 13 States have a place in one or more of these areas."

48. Hickey, Noel and Mulcahy, Risteard **(S-3-IR-65)**

The Significance of Changes in Certified Coronary Heart Disease Mortality Rates in Ireland

IRISH JOURNAL OF MEDICAL SCIENCE 3(4): 163-168, 1970

To determine whether the documented increase in male mortality from coronary heart disease (CHD) in the Republic of Ireland was real, a study was made of the age-adjusted standardized death rates for 1952-65. A comparison of mortality data for males 35-69 years of age for the two periods 1952-54 and 1963-65 revealed that the increase in deaths assigned to CHD (ICD codes 420-422) was significantly greater than the increase in deaths assigned to all codes that could include deaths from CHD (ICD codes 334, 401-416, 420-422, 434, 441-446, and 794). The corresponding decrease in male deaths ascribed to heart disease other than 420-422 was not sufficient to counterbalance the increase in deaths ascribed to 420-422. The authors conclude that the increase in deaths from CHD is real and that the increase is caused to some extent by certain risk factors found in an affluent society.

49. Hoffman, Paul M. and Brody, Jacob A. **(CD-8-US-63)**

The Reliability of Death Certificate Reporting for Amyotrophic Lateral Sclerosis

JOURNAL OF CHRONIC DISEASES 24:5-8, 1971

Hospital records of North Carolina residents with a definite diagnosis of amyotrophic lateral sclerosis (ALS) in three hospitals for the period 1958-63 were reviewed. Death certificates were obtained for 72 of the 85 cases. Forty-eight had ALS as the underlying cause of death and four listed ALS as a contributory cause. Of the 20 certificates with no mention of ALS, 8 were coded as multiple sclerosis and 4 as muscular dystrophy. The authors conclude that mortality data, even in a disease with a distinct clinical picture, should be interpreted with great caution.

50. Holding, T. A. and Barraclough, Brian, M. **(CD-7-UK-70)**

Psychiatric Morbidity in a Sample of a London Coroner's Open Verdicts

BRITISH JOURNAL OF PSYCHIATRY 127:133-143, 1975

(Author's summary) "One hundred and thirty-four deaths recorded as open verdicts in the Inner West London Coroner's District during 1969 and 1970 have been surveyed for evidence of mental illness. For 110 (82 percent) of these deaths the probable verdicts were suicide or accident and they were reclassified as undetermined deaths. Of these deaths 73 percent were diagnosed as mentally ill, 54 percent were receiving medical treatment for psychological symptoms before death, 42 percent had a history of psychiatric care and 24 percent had made a previous

suicide attempt. In these respects undetermined deaths and suicide deaths resemble each other; both are drawn predominantly from the mentally ill."

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51. Holler, Jacob W. and De Morgan, Nicholas P. (AC-9-US-99)

A Retrospective Study of 200 Post-Mortem Examinations

JOURNAL OF MEDICAL EDUCATION 45:168-170, 1970

In a review of 212 autopsies conducted in a university-affiliated teaching hospital, the authors compare clinical with autopsy findings. Complete agreement of clinical-autopsy diagnoses was noted for 52 percent of the cases. In an additional 24 percent, the major diagnosis was correct and minor diagnoses were either missed or wrong: 16 percent of the cases had a correct major diagnosis with confirmation of questionable diagnoses by autopsy and 8 percent had errors in major diagnoses. The authors conclude that in half the cases reviewed, autopsy had provided useful information.

52. Hook, Ernest B.; Farina, Matthew A.; and Hoff, Margaret B. (CD-3-US-73)

Death Certificate Reports of Cardiovascular Disorders in Children: Comparison with Diagnoses in a Pediatric Cardiology Registry

JOURNAL OF CHRONIC DISEASES 30:383-391, 1977

Death certificate diagnoses, clinical diagnoses, and the codes of underlying causes of death were compared for 294 deceased children listed in a pediatric cardiology registry. The registry listed all individuals evaluated by the Division of Pediatric Cardiology at Albany Medical Center between midyear 1967 and December 31, 1973. Based on a review of clinical records, it was judged that in 206 cases, the cardiovascular disorder probably contributed to the death. Of these, the mention of a cardiovascular disorder was made on 90.3 percent of the certificates; however, the major cardiac defect present was specified in only 39.3 percent.

53. Howell, Trevor H. (AC-9-UK-99)

Causation of Diagnostic Errors in Octogenarians: A Clinico-Pathological Study

JOURNAL OF THE AMERICAN GERIATRICS SOCIETY 14(1):41-47, 1966

To emphasize the difficulties in formulating diagnoses in geriatric medicine, clinical diagnoses and pathological verdicts were compared for 50 octogenarians coming to autopsy. The two sources did not coincide in 50 percent of the cases. Cause of death was clinically ascribed most often to cerebral arteriosclerosis (24 percent), diagnosis uncertain (18 percent), senile dementia (16 percent), and cerebrovascular accident (14 percent). Pathologists most often attributed the cause of death to atherosclerosis (28 percent), bronchopneumonia (24 percent), myocardial degeneration (18 percent), and cancer in some organ (10 percent). The factors that contributed to incorrent clinical diagnoses are discussed.

54. Israel, Robert A. and Klebba, A. Joan (DS-9-US-68)

A Preliminary Report of the Effect of Eighth Revision ICDA on Cause of Death Statistics

AMERICAN JOURNAL OF PUBLIC HEALTH 59(9):1651-1660, 1969

(Author's abstract) "The introduction of the Eighth Revision of the International Classification of the Causes of Death has resulted in breaks in mortality trends for many causes. The reasons for these breaks are discussed. To deal with time trends without distortion due to changes in classification, comparability ratios have been prepared and these are explained here."

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55. Jablon, S.; Angevine, D. M.; Matsumoto, Y. S.; and Ishida, M. (AD-9-JP-62)

On the Significance of Cause of Death as Recorded on Death Certificates in Hiroshima and Nagasaki, Japan

NATIONAL CANCER INSTITUTE MONOGRAPH NO. 19: Epidemiological Approaches to the Study of Cancer and Other Chronic Diseases, 1966. pp 445-465.

The Japanese National Institute of Health–Atomic Bomb Casualty Commission Life Span Study, begun in 1947, was concerned with studying survivors of the atomic bombings of Hiroshima and Nagasaki. The sample included a study group of survivors who were within 2,500 meters of the hypocenter at the time of the bombings and two control groups. The sample was followed until death. Autopsies were performed on 1,215 of the study deaths between 1950 and 1962, and the principal autopsy diagnosis was compared with the underlying cause of death recorded on the death certificate. Agreement was good for deaths from malignant neoplams (although these were somewhat underdiagnosed) and for deaths from major cardiovascular-renal diseases when these diseases were considered as a class. Tuberculosis as a certified cause of death became increasingly unreliable over time; however, accuracy of diagnosis of malignancies seemed to improve.

56. Jensen, Ole Moller; Mosbech, Johannes; Salaspuro, Mikko; and Jhamaki, Timo (CD-2-ZZ-71)

A Comparative Study of the Diagnostic Basis for Cancer of the Colon and Cancer of the Rectum in Denmark and Finland

INTERNATIONAL JOURNAL OF EPIDEMIOLOGY 3(2):183-186, 1974

The incidence of and mortality from cancer of the colon and cancer of the rectum are reported to be 2-2½ times higher in Denmark than in Finland. To investigate these differences all death certificates were examined that listed either of these cancers as primary or secondary cause of death and where death had occurred between May and July 1971. No differences were found in rates of registration of other gastrointestinal diseases. Furthermore, the diagnostic criteria for these two cancers were found to be identical for the two countries. The authors assert that the recorded difference between Finland and Denmark is real and not a statistical artifact.

57. Kagan, Aubrey; Katsuki, Shibanosuke; Sternby, Nils; and Vaněček, Rudolf (ACS-4-ZZ-66)

Reliability of Death Certificate Data on Vascular Lesions Affecting the Central Nervous System

BULLETIN OF THE WORLD HEALTH ORGANIZATION 37:477-481, 1967

(Author's abstract) "Although it is generally stated that national mortality statistics are to some extent unreliable, it is difficult to ascertain their degree of unreliability. In studies carried out in limited areas of Czechoslovakia, Japan and Sweden it has been possible to determine the cause of death at autopsy in a large series of cases, and the findings relevant to 'vascular lesions affecting the central nervous system' (CNS) have been compared with the national mortality statistics for the same causes and with the clinical findings.

"It was found that death rates for vascular lesions affecting the CNS, taken as a whole, obtained from the autopsy studies were close to the national figures but that the ratio of cerebral haemorrhage to cerebral infarction was lower in the autopsy data, indicating that classification into cerebral haemorrhage and cerebral thrombosis is incorrect in the national figures and that the former is over-diagnosed at the expense of cerebral thrombosis.

"Comparison of the autopsy data with clinical diagnoses in Prague and Malmo showed that only 70 percent of the cases of fresh cerebral vascular accidents regarded as the principal cause of death by the pathologist were diagnosed before autopsy, and that many cases found by the pathologist but not considered to be the principal cause of death were not suspected clinically. Less than 1 percent of cases of cerebrovascular accident regarded as the principal cause of death by the clinician were not found by the pathologist."

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58. Khoury, Sami A. **(ACD-1-US-67)**

Death Certificates and Tuberculosis Register Cards. A Correlation Study of 108 Cases

AMERICAN REVIEW OF RESPIRATORY DISEASE 104(6):936-937, 1971

The United States has a tuberculosis death rate of approximately 3 per 100,000 yearly. The study was designed to investigate the diagnostic accuracy of deaths coded as tuberculosis. The study group consisted of 108 patients who died between January 1, 1966 and December 31, 1967 and whose death certificates were matched with a tuberculosis register card. Forty-six percent of the deaths with tuberculosis as immediate or underlying cause were inactive cases on the registry. The authors conclude that tuberculosis tends to be overreported as a cause of death.

59. Knight, Mark V. **(CD-2-US-99)**

The Accuracy of Mortality Statistics

Bureau of Health Statistics, Division of Health, Wisconsin Department of Health and Social Services, Working papers, Sept. 17, 1976, and Feb. 21, 1977. Unpublished.

A sample of 550 death certificates with cancer as the underlying cause were selected from certificates filed with the Wisconsin Bureau of Health Statistics (years of data not given). The certifiers were queried by mail regarding (1) the methods used prior to death to diagnose the cancer, (2) the methods used at or after death in determining that cancer was the underlying cause, and (3) the certifier's confidence in the diagnosis of cancer as the underlying cause. Eighty-seven percent of the 513 returned questionnaires indicated that histopathological confirmation of the cancer diagnosis was obtained at some time. However, only one-third received histopathological confirmation at or after death. The quality of the diagnostic information was related to age of decedent and place of death, but not to site.

A second sample of 300 certificates was drawn from those certificates with an underlying cause other than cancer. Certifiers were asked whether there was a history of cancer in the deceased. Twenty-one (7.5 percent) said yes, (but for 18 of these, the cancer was under control), 288 said no, and 30 said they did not know.

60. Krueger, Dean E. **(D-9-US-62)**

Hypertensive and Chronic Respiratory Disease Mortality: Confirmation of Trends by Multiple Cause of Death Data

PUBLIC HEALTH REPORTS 81(2):197-198, 1966

This study investigates a possible cause of the trends in hypertensive and chronic respiratory disease rates since 1949. Death certificates of veterans holding life insurance policies issued before 1940 and who died between July 1954 and the end of 1962 were collected; up to three causes of death were coded for each death. Average annual age-specific death rates were calculated for each of three subdivisions of an 8½ year period, for hypertensive disease and for bronchitis and emphysema as underlying causes and as associated causes. Age-adjusted rates are presented. For hypertensive disease, both the underlying cause and the associated cause rates decreased. The rates for bronchitis and emphysema as the underlying cause increased, as did the rates for these conditions as an associated cause. The author concludes that the trends for these conditions are not simply caused by a shift in reporting these diseases from associated causes to underlying causes, and offers explanations for the trends.

61. Kuller, Lewis H.; Anderson, Herbert; Peterson, Donald; et al. **(ACD-4-US-65)**

Nationwide Cerebrovascular Disease Morbidity Study

STROKE 1:86-98, 1970

This study, designed to investigate geographic differences in stroke morbidity and mortality rates, was carried out in eight of the nine areas that participated in the Nationwide Mortality Study (see Number 63 in this report). Stroke cases were ascertained through the diagnostic indexes of participating hospitals for white persons aged 45-69 years during 1965, and through case lists used in the Nationwide Mortality Study. Analysis was limited to the six areas in which at least 90 percent of the hospital records were available for review. The high mortality areas in the Southeastern United States apparently also have a higher incidence of stroke than the low stroke mortality areas. About 80 percent of the stroke diagnoses could be verified by an autopsy report, arteriography, hemorrhagic spinal fluid, hemiplegia, or coma on admission.

62. Kuller, Lewis H.; (CD-4-US-65)
Blanch, Thomas; and
Havlik, Richard

Analysis of the Validity of Cerebrovascular Disease Mortality Statistics in Maryland

JOURNAL OF CHRONIC DISEASES 20:841-851 1967

To study the validity of cerebrovascular disease diagnoses, a sample of death certificates, stratified according to underlying cause of death, were selected from certificates for deaths of persons aged 40 to 75 who died in Baltimore City in the first 6 months of 1965 and in the eastern and western areas of Maryland in all of 1965. Information about the deaths was gathered from several sources, including hospitals, attending physicians, and medical examiners. A review of the available information showed that of the 364 deaths in hospitals for which cerebrovascular disease was mentioned on the certificate, the disease was probably not present in 19.8 percent. Furthermore, cerebrovascular disease was not mentioned for 19.8 percent of the 356 hospital deaths that were attributed to the disease as a result of the review. Numerous other statistics relating to the validity of the certified cause of death were presented.

63. Kuller, Lewis H.; (ABCD-4-US-65)
Bolker, Abraham;
Saslaw, Milton, S.; et al

Nationwide Cerebrovascular Disease Mortality Study. I. Methods and Analysis of Death Certificates

AMERCIAN JOURNAL OF EPIDEMIOLOGY 90(6): 536-544, 1969

(Author's abstract), "Large differences in cerebrovascular disease (CVD) mortality among the geographic areas of the United States have been reported. In order to determine whether these geographic differences might be due to differences in certification practices or accuracy of the diagnosis of stroke, a study of death certificates in 9 areas of the United States – 3 with high, 3 intermediate and 3 with low cerebrovascular disease death rates for white males ages 35-74–was completed. A stratified sample of 6,314 death certificates was included in the study. The information on the death certificate was then compared with clinical data from hospital records, physician's reports and medical examiner's records. Cerebrovascular disease had been listed as underlying cause of death on 1,232 death certificates in the original sample and 1,310 after adjusting for sampling. Stroke was listed as underlying cause for 1,310 (66.8 percent) of the 1960 certificates listing stroke as either underlying or contributing cause of death. There were no substantial differences among the areas. The age and sex distribution, place of death, type of stroke listed on the certificate and the frequency with which stroke appeared on the same certificate with hypertension, arteriosclerotic heart disease and diabetes were similar in the high, low and intermediate cerebrovascular death rate areas. The variations in death rates could not be explained by differences in certification practices such as choice of the underlying cause of death among all death certificates listing stroke."

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64. Kuller, Lewis H.; (ABCD-4-US-65)
Bolker, Abraham;
Saslaw, Milton S.; et al.

Nationwide Cerebrovascular Disease Mortality Study. II. Comparison of Clinical Records and Death Certificates

AMERICAN JOURNAL OF EPIDEMIOLOGY 90(6): 545-555, 1969

(Author's abstract) "The large differences in cerebrovascular disease mortality among geographic areas of the United States cannot be explained by variations in certification practices such as the choice of the underlying cause of death. There may be differences in the frequency that clinical stroke diagnoses on hospital records, physician's and medical examiner's reports or from a family interview were listed on the death certificate. In order to measure the relationship between clinical stroke diagnosis and information on the death certificate, pertinent clinical records were reviewed for every death certificate included in the nationwide cerebrovascular disease mortality study. Clinical information or a family interview was obtained for 96.5 percent of the 16,956 death certificates in the adjusted sample. When all sources of stroke diagnosis were pooled together, it was found that 18.9 percent of the deaths had a stroke diagnosis. The frequency was highest in the high cerebrovascular disease death rate areas. Approximately 60 percent of all stroke diagnoses were listed on the death certificate including 42.2 percent as the underlying cause of death. Differences among the areas were comparatively small. The sensitivity of the death certificate was highest for hospital deaths and lowest for those certified by the medical examiner, while the specificity was the same irrespective of the place of death. Differences in the frequency in which clinical stroke diagnoses were

listed on the certificate did not explain the geographic differences in death rates."

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65. Kuller, Lewis, H.; (ACD-4-US-65)
Bolker, Abraham;
Saslaw, Milton S.; et al.

Nationwide Cerebrovascular Disease Mortality Study. III. Accuracy of the Clinical Diagnosis of Cerebrovascular Disease

AMERICAN JOURNAL OF EPIDEMIOLOGY 90(6): 556-566, 1969

(Author's abstract) "The large differences in cerebrovascular disease mortality among geographic areas of the United States may be due to differences in the accuracy of the diagnosis of stroke. The accuracy of the diagnosis of stroke among areas of the United States with high, intermediate or low cerebrovascular mortality rates was studied by reviewing clinical records for every death included in the nationwide cerebrovascular disease mortality study. The frequency of most symptoms of stroke was similar among the areas. For stroke deaths in a hospital, hemiplegia was listed on 55 percent of the hospital charts and coma on 65.7 percent. Approximately 85 percent of the hospital stroke deaths could be validated by either an autopsy, arteriogram, hemorrhagic spinal fluid, hemiplegia or coma on admission. There were no differences among the high, low and intermediate cerebrovascular disease mortality areas. When stroke was the underlying cause on the death certificate, 69.5 percent of the clinical records from hospitals, physicians or medical examiners reported coma; 49.1 percent, hemiplegia; 25.8 percent, an autopsy of the brain; 33.4 percent, a spinal puncture; 7.9 percent, an arteriogram and 2.4 percent, a craniotomy. Differences in the accuracy of the diagnosis of stroke apparently did not account for geographic variations in cerebrovascular disease mortality among areas of the United States."

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66. Kuller, Lewis H.; (ABCD-3-US-65)
Lilienfeld, Abraham; and
Fisher, Russell

Sudden and Unexpected Deaths Due to Natural Causes in Adults – A Comparison of Deaths Certified and Not Certified by the Medical Examiner

ARCHIVES OF ENVIRONMENTAL HEALTH 13: 236-242, 1966

(Author's summary) "A study of sudden and unexpected nontraumatic deaths between June 15, 1964, and June 14, 1965, was completed in Baltimore. The deaths were studied by reviewing all available medical information [for a stratified sample of death certificates for Baltimore residents aged 20-64] in order to determine: (1) whether the death was possibly sudden or not; and (2) the accuracy of the diagnosis as reported on the death certificate.

"There were 1,857 deaths in the original sample, and 589 were sudden and unexpected; after adjusting for sampling it was estimated that 1,178 (32 percent) of 3,648 deaths were sudden.

"The medical examiner certifies more sudden deaths in the younger age group, in Negroes, and in males. While 77 percent of unwitnessed sudden deaths are certified by the medical examiner, only 23.1 percent of those witnessed between 2 and 24 hours in the 40-64 year age group were certified. Sudden deaths not due to arteriosclerotic heart disease were more likely to have been certified by the medical examiner. Sudden deaths in the upper socioeconomic classes, and especially those deaths with a history of either a recent visit to a physician or heart disease, were usually not certified by the medical examiner. Therefore, adequate studies of sudden death must include both deaths certified and not certified by the medical examiner."

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67. **Kuller, Lewis H.; Lilienfeld, Abraham; and Fisher, Russell** (ABCD-3-US-65)

Epidemiological Study of Sudden and Unexpected Deaths Due to Arteriosclerotic Heart Disease

CIRCULATION 34:1056-1068, 1966

A sample of all nontraumatic deaths occurring from June 15, 1964 to June 14, 1965 of Baltimore residents aged 20-64 years was studied to determine the frequency and cause of sudden death in a defined population. Of the original 1857 deaths selected for study, 589 were classified as sudden and unexpected. For comparison, information was obtained on two additional groups; a probability sample of deaths of white male Baltimore residents aged 40-64 years and all arteriosclerotic heart disease (ASHD) deaths that were not sudden. Hospital records, autopsy protocols, physician reports, and interviews with witnesses were studied to evaluate the accuracy of the cause-of-death diagnosis. Based on this evidence, ASHD was selected as the most likely cause of death in 489 deaths. Of these deaths, 92.6 percent were correctly assigned to ASHD on the death certificate, and the remaining cases listed ASHD as either immediate or contributing cause. An investigation was also made of (1) differences in frequency and cause of sudden death between racial and socioeconomic groups, (2) the relationship of ASHD sudden deaths to prior history of heart or cardiovascular disease and to prior medical treatment, and (3) the circumstances surrounding the death.

68. **Kuller, Lewis H.; Lilienfeld, Abraham; and Fisher, Russell** (ABCD-3-US-65)

Quality of Death Certificate Diagnoses of Arteriosclerotic Heart Disease

PUBLIC HEALTH REPORTS 82(4):339-346, 1967

(Author's summary) "Nontraumatic deaths of Baltimore residents aged 20-64 years, occurring between June 15, 1964 and June 14, 1965, were investigated. The accuracy of the diagnosis listed on the death certificate was determined by reviewing available medical information and from interviews of next-of-kin or other relatives or friends of the dead person.

"A stratified sample of approximately 50 percent (1,857) of the total deaths was reviewed. In 553 (29.8 percent) of these 1,857 deaths arteriosclerotic heart disease was considered to be the principal cause of death. Of the 553 deaths due to arteriosclerotic heart disease 488 (88.4 percent) occurred within Baltimore City. In 452 (92.6 percent) arteriosclerotic heart disease (rubrics 420 and 422) had been considered as the underlying cause of death and in the other 36 (7.4 percent) as either an immediate or contributing cause. Because of the rapidity of the events leading up to the deaths attributed to arteriosclerotic heart disease, the accuracy of the diagnosis is often based only on a history of heart disease, suddenness of the death, and the absence of other significant diseases."

69. **Kunitz, S. J. and Edland, J. F.** (DS-9-US-70)

The Epidemiology of Autopsies in Monroe County, New York

JOURNAL OF FORENSIC SCIENCES 18(4):370-379, 1973

In an effort to assess the validity of mortality statistics for Monroe County, New York, death certificates were obtained for all county residents who died in the 11-year period 1960-70. Autopsy rates were calculated from the autopsy information recorded on the certificate, and the rates were analyzed by age, sex, and race of the decedent, and by year, cause, and place of death. Autopsy rates were disproportionately higher for younger and for black persons. The authors feel that this is justified to some extent by the unnaturalness of these deaths; however, they recommend that more effort be spent in understanding the chronic and degenerative diseases of the steadily growing population of elderly persons.

70. **Lombard, Herbert L.; Huyck, Evelyn P.; and Snegireff, Leonid S.** (CD-2-US-58)

An Appraisal of the Cancer Death Record

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 48(12):2059-2062, 1962

The authors cite four factors that make death record studies of cancer by site unsatisfactory: (1) errors in diagnosis, (2) recording of the site of metastasis rather than the primary site, (3) imprecise reporting of site, and (4) recording of the correct noncancer cause of death when cancer was also present. To study these problems, death records were obtained for 13,246 individuals who had attended Massachusetts cancer clinics from 1946 through 1958 and who died after 1948. The death certificates were compared with clinical records, and problems of

understatement and overstatement were studied for 10 cancer sites. The problems as they pertain to lung cancer are discussed in detail. The authors found that these errors were compensating to some extent, but were skeptical of the value of death records for epidemiological purposes.

71. Lombard, Herbert L. and Joslin, Elliott P. (CD-8-US-57)

Underlying Causes of Death of 1,000 Patients with Diabetes

NEW ENGLAND JOURNAL OF MEDICINE 259: 924-926, 1958

To investigate the change in diabetes mortality rates caused by the introduction of the sixth revision of the ICD, death certificates of 1,000 patients with diabetes diagnosed at the Joslin Clinic were studied. All patients had died in the period 1950-57. The findings were compared with findings of a previous study of the coding of 1,000 deaths of diabetics. Only 33 percent had diabetes as the cause of death under the sixth revision, a decrease from 66 percent. In the earlier study, 10 percent had diabetes mentioned on the certificate but another cause was registered, compared with 44 percent for the current study. Diabetes was not mentioned on the certificates of the remaining cases.

72. Lundberg, George D. and Voigt, Gerhard E. (A-9-SW-76)

Reliability of a Presumptive Diagnosis in Sudden Unexpected Death in Adults: The Case for the Autopsy

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 242(21):2328-2330, 1979

One hundred cases of sudden unexpected death in adults (SUDA) were studied to determine the value of autopsy in assigning the cause of death for cases of SUDA. The study cases were 100 consecutively autopsied case of SUDA, occurring in Sweden in July or August, 1976, in which no cause of death was apparent. A distribution of the cases by autopsy cause of death is shown, followed by a discussion of the errors that might have arisen had the cause of death been assigned without autopsy.

73. Markush, Robert E. (BD-5-US-64)

National Chronic Respiratory Disease Mortality Study I. Prevalence and Severity at Death of Chronic Respiratory Diseases in the United States, 1963

JOURNAL OF CHRONIC DISEASES 21:129-141, 1968

(Author's summary) "The certifiers of 3193 U.S. deaths, aged 35-74 were queried by mail on the presence and severity of several chronic respiratory diseases (excluding tuberculosis, lung cancer and occupational pneumoconioses), in order to evaluate published vital statistics which indicate a marked increased since 1950 in the U.S. death rate from these diseases.

"The prevalence at death of the chronic respiratory diseases was found to be more than nine times greater than its underlying cause death rate. It was also found that U.S. death certifiers in 1963 listed on the death certificates only half of the severe chronic respiratory disease present at death, suggesting that vital statistics based on death certificates may seriously underestimate the contribution of chronic respiratory diseases to U.S. deaths. Such epidemiologic observations on the chronic respiratory diseases as their rapidly increasing U.S. mortality rate, their relatively small contribution to mortality in the U.S. when compared to the U.K., and their relatively high mortality rates in several states could be statistical artifacts arising from variation in habits of death certification."

NOTE: The sample included all (837) deaths of white persons aged 35-74 years, from the 10 percent Current Mortality Sample for July through September 1963 with mention of chronic respiratory disease anywhere on the death certificate. The remaining 2,356 deaths were selected systematically (every 200th death) from the death certificates of white, U.S. native-born persons, aged 35-74 years from 12 States on file at the National Center for Health Statistics for January through March 1963 and January 1964.

74. Markush, Robert E.; Schaaf, William E.; and Seigel, Daniel G. (BD-9-US-62)

The Influence of the Death Certifier on the Results of Epidemiologic Studies

JOURNAL OF THE NATIONAL MEDICAL ASSOCIATION 59(2):105-113, 1967

(Author's summary) "This report investigates the bias introduced into epidemiological studies by differences in the distributions of selected characteristics of the certifiers of deaths.

"It was found that a potential source of bias in studies of the effects of urbanicity may derive from differing proportions of certifiers who were board specialists inside and outside metropolitan areas. Similarly, cigarette smoking studies may be distorted by different lengths of certifier attendance and by different proportions of medicolegal deaths among smokers and nonsmokers. The alternative interpretation that observed differences in the distributions of diagnoses among certifiers are the result of differences in the kinds of patients that they see is not dismissed. It is suggested that giving more attention to the characteristics of certifiers of deaths would increase the reliability of epidemiological studies of mortality."

NOTE: The study group on which this pilot study was based consisted of a sample of 507 death certificates from 12 states obtained from the National Vital Statistics Division for the months of November and December 1962. The sample was restricted to white male decedents aged 35-74 years and white female decedents aged 30-74 years. A questionnaire was sent to the informant listed on each death certificate in order to obtain the decedent's smoking history. Characteristics of the certifier of the death were obtained from the death certificates and from the 22nd edition, 1963, of the American Medical Directory, published by the American Medical Association.

75. Marshall, Thomas K. **(AB-9-IR-67)**

The Value of the Necropsy in Ascertaining the True Cause of a Non-Criminal Death

JOURNAL OF FORENSIC SCIENCES 15(1):28-33, 1970

(Author's summary) "This paper reports the errors in diagnosing the cause and category of death, whether homicide, accident, suicide, or natural causes, likely to be introduced when a clinical assessment is relied upon instead of the cause and circumstances of the death being confirmed by necropsy. An analysis of 1,000 consecutive coroner's necropsies [performed between January 1966 and January 1967 in Northern Ireland] was carried out and the diagnosis made from the history alone was found to be quite wrong in 11.3 percent cases when checked against the necropsy findings. This error was a minimum one, likely to have been greater if the diagnoses had been made by someone inexperienced in forensic pathology. The significance of the misdiagnoses is commented on."

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76. McCarthy, P. Desmond and Walsh, Dermot **(BD-7-IR-68)**

Suicide in Dublin: I. The Under-reporting of Suicide and the Consequences for National Statistics

BRITISH JOURNAL OF PSYCHIATRY 126:301-308, 1975

(Author's summary) "This study of suicide in Dublin during 1964-1968 from coroners' records was undertaken to estimate the discrepancy between coroners' verdicts, the national suicide statistics compiled from them and the clinical assessment of probability of suicide by psychiatrists examining the same records. The large difference in numbers of suicides deriving from the two approaches has considerable implications for national suicide statistics, and these have been briefly considered. From the findings presented we believe that we are justified in concluding that: (a) there are real differences in national suicide rates, at least between Ireland, England and Wales, and Scotland, and (b) the Irish suicide rate is low, though not as low as official statistics suggest, and (c) the discrepancy between official and 'true' suicide rates in Ireland is greater than in England and Wales and in Scotland."

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77. Mitchell, Roger S.; Maisel, John C.; Dart, Gladys A.; and Silvers, G. Wayne **(AD-5-US-70)**

The Accuracy of the Death Certificate in Reporting Cause of Death in Adult: With Special Reference to Chronic Bronchitis and Emphysema

AMERICAN REVIEW OF RESPIRATORY DISEASE 104:844-850, 1971

A study was made of 634 persons 40 years of age or over who died and were autopsied at either Colorado General or Denver Veterans Administration Hospital between September 1959 and May 1970. In 578 of the autopsies, special attention was given to the heart and lungs. The autopsy findings and clinical records were studied to determine the most likely cause of death for each study case. Underreporting of chronic bronchitis and emphysema was found to decrease over the 12-year study period. Also, there

was overreporting of these conditions as underlying cause of death when death had actually been caused by another condition. Fifty-six percent of the unautopsied cases listed chronic bronchitis or emphysema on the death certificate, compared with an expected rate of 74 percent estimated from the autopsy study. These findings indicate that chronic airway obstruction is underreported as a cause of death.

78. Mitchell, Roger S.; Walker, Strother H.; Silvers, G. Wayne; Dart, Gladys A.; and Maisel, John C. **(AD-5-US-66)**

The Causes of Death in Chronic Airway Obstruction. I. The Unreliability of Death Certificates and Routine Autopsies

AMERICAN REVIEW OF RESPIRATORY DISEASE 98(4):601-610, 1968

To determine whether mortality statistics for chronic airway obstruction (CAO) are accurate, a study was made of 263 subjects with a history of dyspnea on exertion, a physical examination revealing generalized impairment of airflow, and, in most cases, physiologic evidence of diffuse airway obstruction. These subjects died between September 1959 and December 1966 in Colorado. Autopsies were performed on 173, with special studies of lungs done on 134 of the subjects from three Denver hospitals. Also included in the study were 253 autopsied subjects without clinical evidence of CAO and on whom special lung studies were done. It was determined that 101 of the 134 CAO patients on whom lung studies were performed died as a direct result of chronic airway obstruction. Only 79 of the 101 patients had CAO reported as a cause of death. In the other 33 patients in whom it was determined that CAO was not the underlying cause of death, three were reported as if CAO was the underlying cause. The authors compared autopsied and unautopsied patients with CAO and found that the rates for myocardial infarction, cerebrovascular accident, and arteriosclerotic heart disease were inflated for the unautopsied patients. Comparison of the routine autopsy with the special lung studies showed important discrepancies in one-fourth of the cases. The authors conclude that there was an underreporting of the CAO on death certificates, causing the mortality rates for CAO to be underestimated.

79. Modan, Baruch; Sharon, Ezra; and Jelin, Navah **(AC-3-IS-64)**

Factors Contributing to the Incorrect Diagnosis of Pulmonary Embolic Disease

CHEST 62(4):388-393, 1972

(Author's abstract) "A study of 2,107 consecutive patients on whom an autopsy had been performed in one major medical center during a 4-year period revealed 545 who had had either a clinical or pathologic diagnosis or both of a pulmonary embolus. The frequency of a false negative diagnosis was 66.6 percent, and the frequency of false positives of all cases with a clinical diagnosis of pulmonary embolus was 61.9 percent. The frequencies were unrelated to age, sex, or ethnic origin, but were slightly lower among patients who died on the surgical ward. A variety of clinical factors and in particular the underlying disorder, played a role in both false positive and false negative diagnoses. Lack of ECG and chest x-ray examinations increased the false negative rate, but had no effect on the false positive rate. The cases with false negative diagnoses differed from those with correct diagnoses in the location of the embolus and in a lower frequency as cause of death."

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80. Moriyama, Iwao M. **(D-9-ZZ-99)**

Comparison of Cause-of-Death Coding: Canada, England and Wales, United States of America

World Health Organization report 1958. Unpublished.

To investigate the variation among countries in the assignment and coding of the cause of death, three countries (Canada, England and Wales, and the United States) were asked to participate in the following study. Each country selected 1,000 death certificates, typical of that nation's death records with respect to causes of death and the type of certificate that might be encountered in that country. Each country coded the 3,000 death certificates, using their standard procedures. The United States National Office of Vital Statistics submitted two sets of codes, one coded by using routine procedures and the second including a further check by a coding instructor in consultation with the coding supervisor. A comparison of the four sets of codes indicated that

coding errors were made regularly, but that the errors were compensating to some extent within groups of categories. Errors were found that would be corrected when the seventh revision of the ICD was introduced. Many of the errors resulted from different views on what constitutes a "highly improbable sequence" of causes of death being listed on the death certificate. The WHO proposed a further investigation to test the effect of the seventh revision of the ICD and the Rules of Selection.

81. Moriyama, Iwao M. **(CD-3-US-56)**

Factors in Diagnosis and Classification of Deaths from CVR Diseases

PUBLIC HEALTH REPORTS 75(3):189-195, 1960

A sample of 1,837 death certificates of patients dying in Pennsylvania during a 3-month period in 1956 were studied to determine the problems of diagnosis, reporting, and classification of cardiovascular-renal (CVR) diseases. (For a summary of study methods, see No. 82 in this report.) Using supplementary information obtained from the certifying physician, the author found that for the 1,406 CVR deaths, 47 percent of the records had supporting diagnostic information that was sketchy in type and amount. In 80 percent of the 1,194 CVR deaths certified by a physician, the diagnoses were reasonable or solidly established. When a physician had decided on the diagnosis, it was found that the underlying cause and contributory cause of death were correctly worded and ordered on 94 percent of the certificates. The author concludes that a universal adoption of diagnostic criteria would improve CVR mortality statistics, but that CVR mortality statistics were accurate enough to show general trends in mortality.

82. Moriyama, Iwao M.; Baum, William S.; Haenszel, William M.; and Mattison, Berwyn F. **(CD-9-US-56)**

Inquiry into Diagnostic Evidence Supporting Medical Certifications of Death

AMERICAN JOURNAL OF PUBLIC HEALTH 48 (10):1376-1387, 1958

A subsample of the 10 percent Current Mortality Sample (CMS) of deaths registered in the State of Pennsylvania, during a 3-month period in 1956, was used to ascertain the quality of cause-of-death certification. The subsample, which totaled 1,837 deaths, excluded deaths due to accidents, suicides, and homicides, included only a portion of deaths due to cardiovascular-renal causes, and was augmented by inclusion of all deaths from cancer of the respiratory system occurring during the study period. A follow-back study was conducted with the certifying physician to obtain information on (1) diagnostic methods and findings on which the certified cause of death was based, (2) an expression of his certainty of the diagnosis, and (3) a revised medical certification if his opinion had changed. Coroners and medical examiners who certified deaths were queried in a similar manner, except that item (2) was excluded. For the 1,837 sample deaths, 4 percent had no support of the diagnosis because additional information was not obtained. In 38 percent the supporting data were sketchy. The remaining 58 percent of the diagnoses had very good or good support. The certifications were rated with respect to consistency with the diagnostic information reported, showing that for 79 percent the certified cause was the most probable diagnosis, for 13 percent another diagnosis was equally probable, and for 5 percent another diagnosis was preferred.

83. Moriyama, Iwao M.; Dawber, Thomas R.; and Kannel, William B. **(CD-3-US-60)**

Evaluation of Diagnostic Information Supporting Medical Certification of Deaths from Cardiovascular Disease

NATIONAL CANCER INSTITUTE MONOGRAPH No. 19: Epidemiological Approaches to the Study of Cancer and Other Chronic Diseases, 1966. pp. 405-419.

(Author's summary) "Questionnaires were sent to the medical certifiers and others with knowledge of the case on a national sample of 1,362 cardiovascular-renal disease deaths [occurring in July and August, 1960] to secure information on diagnostic methods used and pertinent findings on which the medical certification of death was based. Data were also obtained on sudden and unexpected deaths and presence or absence of associated diseases. The returns were reviewed and determination made as to whether the assigned cause of death was supported by diagnostic data provided by the certifier.

"It is estimated that from 70 to 75 percent of deaths classified as cardiovascular disease in the United States may be considered as a reasonable inference or better. With a higher rate of usable response, this estimate would have been somewhat higher. About 10 percent of deaths from cardiovascular diseases were sudden and unexpected deaths.

"Large proportions of related diseases such as diabetes and certain chronic bronchopulmonary

diseases were not reported on death certificates as contributing to death."

84. Murphy, Gordon K. **(A-2-US-99)**

Cancer and the Coroner

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 237(8):786-788, 1977

Thirteen hundred consecutive forensic autopsies performed by the author in Dayton, Ohio and Baltimore, Maryland were reviewed (1,287 included brain examination), and 22 malignancies (1.7 percent) were found. Cancer was incidental in nine cases, the cause of sudden death in six, an unusual presentation in three, and associated with suicide in four. This review did not include coroner's cases where cancer was known to exist. The author comments on the importance of accurate autopsies in the medicolegal setting.

85. Murphy, Thomas **(CDS-2-IR-64)**

Certification of Death from Cancer of the Uterus

JOURNAL OF THE IRISH MEDICAL ASSOCIATION 60(364):385-388, 1967

Using the sixth revision ICD codes for uterine cancer – (171) malignant neoplasm of the cervix, (172) malignant neoplasm of the corpus uteri, (173) malignant neoplasm of other parts of the uterus including chorioepithelioma, and (174) malignant neoplasm of the uterus–unspecified–the authors present a frequency distribution, by coded cause, of women dying of uterine cancer in 1964 in Ireland. For 149 of the 157 deaths coded to ICD 171-174, the author collected additional information about the cause of death and reduced the number of cases in the ICD 174 category from 95 to 16. Most were reclassified as cancer of the cervix or corpus. The ratio of cancer of the cervix to corpus uteri was reduced significantly as a result. The author concludes that if followup were instituted for all causes of death, the resultant mortality statistics would be more accurate.

86. Murphy, Thomas and Joyce, Nessa **(S-2-IR-68)**

Certification of Death from Cancer of the Uterus

JOURNAL OF THE IRISH MEDICAL ASSOCIATION 63(396):235-236, 1970

In a review of cancer of the uterus in Ireland, the author presents tables showing a decline in the use of the indefinite category "Malignant neoplasm of the uterus, unspecified" between 1961 and 1968. Additional tables are presented that show similar patterns of certification for other indefinite categories of the ICD selected from codes for Arteriosclerotic and Degenerative Heart Disease (420-422) and Symptoms, Senility, and Ill-defined Conditions (730-795). The authors conclude that accuracy in the certification of death has improved but that even greater accuracy is needed.

87. Najem, G. Reza; Riley, Harris D., Jr.; and Najem, Leila I. **(CD-3-US-70)**

Reliability of Heart Disease Diagnoses

JOURNAL OF THE OKLAHOMA STATE MEDICAL ASSOCIATION 68(12):452-457, 1975

A study of the reliability of heart disease diagnoses was made using death certificates for Oklahoma City for 1969 and 1970. The study sample included all certificates listing hypertensive and chronic rheumatic heart disease as immediate cause of death, and 10 percent of those listing ischemic heart disease as immediate cause. For 150 of the 159 selected cases, clinical information was collected and evaluated using predetermined clinical criteria. When sudden deaths were excluded, the reliability of the cause of death was found to be 71 percent for chronic rheumatic heart disease, 49 percent for ischemic heart disease, and 47 percent for hypertensive heart disease. The reliability of heart disease diagnoses was shown to depend on sex, type of medical center where patient died, race, and marital status. The authors concluded that death certificate information must be refined and adjusted for the proportion of incorrect assignments of cause of death before the data can be used for research purposes.

88. Nelson, Franklyn L.; Farberow, Norman L.; and MacKinnon, Douglas R. **(B-7-US-75)**

The Certification of Suicide in Eleven Western States: An Inquiry into the Validity of Reported Suicide Rates

SUICIDE AND LIFE-THREATENING BEHAVIOR 8(2):75-88, 1978, Human Sciences Press

(Author's abstract) "From Durkheim's time to the present social researchers interested in the problem of suicide have relied upon officially reported rates of suicide to develop and test their theories. Despite the fact that the validity of any theory rests upon the

accuracy of its underlying data, the relative accuracy of reported suicide rates have rarely been questioned or systematically evaluated. This paper investigates the process of death certification as practiced by a sample of 191 coroners in 11 western states. Findings indicate extensive variation in the backgrounds, professional resources, operating procedures, and governing statutes of coroners and coroners' offices and in policies concerning the use of the suicide mode. Since the coroner is generally charged with the official responsibility for certifying the mode of death when unnatural mode is suspect, the extent of variation found here calls into question the validity and comparability of reported suicide rates."

Reprinted with permission of Suicide and Life-Threatening Behavior.

89. Newhouse, M. L. and Wagner, J. C. (ACD-2-UK-64)

Validation of Death Certificates in Asbestos Workers

BRITISH JOURNAL OF INDUSTRIAL MEDICINE 26:302-307, 1969

A study to validate certified causes of death was made of 158 asbestos factory workers who died before 1964 and for whom necropsy reports were available. In 84 of the cases, histological material also was obtained. Four additional cases of carcinoma of the bronchus were identified in the group for which only necropsy reports were available, and another four cases of carcinoma of the bronchus and 15 mesotheliomata were discovered in the group for which histological material also was reviewed. Some degree of asbestosis was found in 60 of the 67 cases for which lung sections were available.

90. Padley, Richard (DS-9-CY-56)

Cause-of-Death Statements in Ceylon: A Study in Levels of Diagnostic Reporting

BULLETIN OF THE WORLD HEALTH ORGANIZATION 20:677-695, 1959

(Author's abstract) "The author presents a critical discussion of the current system of registration of deaths in Ceylon, pointing out the difficulties inherent in collecting and analysing data relating to causes of death in a country where many of the cause-of-death statements are made by lay registars whose knowledge of modern medical terminology is slight or non-existent. He suggests various ways in which the present system might be improved, stressing particularly the need for continuous scrutiny of the Sinhalese or Tamil terms commonly used in reporting causes of death in rural areas and for the preparation of simple instructions to lay registrars regarding a system of priorities to be followed in selecting the symptoms to report as a result of interrogation of the relatives notifying the death."

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91. Penttilä, Antti and Ahonen, Antti (DS-3-FN-68)

Arteriosclerotic and Other Degenerative Heart Diseases in Finland. I. A Death Certificate Study of the Frequency of Degenerative Heart Diseases among Males and Females

SCANDINAVIAN JOURNAL OF SOCIAL MEDICINE 3(2):61-67, 1975

(Author's abstract) "All available information recorded on the death certificates of 12,973 Finnish persons who, according to the official Finnish mortality statistics, died in 1968 from arteriosclerotic and other degenerative heart diseases (ADHD, rubrics 420-422 in ICD) comprised the material of the present study. The mortality of males from ADHD analysed by age and place of residence was very high when compared with various national rates of international WHO statistics. The degree of urbanization of the domicile did not have any statistically significant effect on the mortality of ADHD. Significant differences between various provinces were found in the mortality of males from ADHD. The male population living in the eastern provinces of Finland showed a highly significantly higher mortality from degenerative heart diseases than the male population living on the west coast. A highly significant difference was found in mortality between various subgroups of the Finnish male and female populations analysed by age, place of residence, and type of community. The uniform difference between the mortality of various male and female subgroups of the Finnish population, which was obtained using the present statistical survey of death certificates, and the fairly uniform distribution of high rate of mortality of males from degenerative heart diseases in most regions of the country lend further support to the reliability of cause-of-death statistics, since certification of deaths can then be regarded to occur uniformly and with about the same accuracy in different parts of the country."

Reprinted with permission of the Scandinavian Journal of Social Medicine.

92. Penttilä, Antti and Ahonen, Antti **(DS-3-FN-68)**

Arteriosclerotic and Other Degenerative Heart Diseases in Finland. II. A Death Certificate Study of the Examination of the Cause of Death from Degenerative Heart Diseases

SCANDINAVIAN JOURNAL OF SOCIAL MEDICINE 3(2):69-74, 1975

(Author's abstract) "A statistical survey of death certificates was made to analyse the ante-mortem and post-mortem medical and medico-legal examinations used in the determination of the cause of death of 12,973 decedents who were recorded officially to have died of arteriosclerotic and other degenerative heart diseases in Finland in 1968. The relationship between the regional autopsy rate and the rate of mortality from degenerative heart diseases was studied in particular. The survey indicated that there was no systematic relationship between the type of ante-mortem and post-mortem cause-of-death examinations, including medical and medico-legal autopsies, and the rate of mortality from arteriosclerotic and other degenerative heart diseases in various groups of the Finnish population analysed by age, sex and domicile. This was concluded to be an indication of the reliability of Finnish cause-of-death statistics of degenerative heart diseases which show a generally high rate of mortality and prominent regional differences in the rate of deaths from those diseases among the Finnish male population."

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93. Peterson, D. R. **(BCD-9-US-73)**

Final Contract Report to the National Institutes of Health: Cardiovascular and Respiratory Disease Mortality

Contract Report, NIH-NHLI-72-2952(C), Unpublished

To test the utility of mail questionnaires for obtaining additional information on deaths due to heart and lung causes, the National Heart and Lung Institute conducted a feasibility study based on a sample of 928 deaths of residents 35-74 years of age in Washington State between October 1, 1972 and October 1, 1973. Deaths due to cancer, accident, poisoning, or violence were excluded. Death record informants, physicians, funeral directors, and hospitals were queried by mail and by personal interview to obtain information on medical attention in the year prior to death, functional limitation in the same period, suddenness of death, and place of death. Tables are included that show completion rates and agreement in reporting of specific items by various sources. The quality of the new information obtained was questionable since the death certificate information agreed with data from supplementary sources only 50-80 percent of the time. The author concludes that the death certificate followback study is a relatively expensive method of obtaining information that is of dubious quality.

94. Preston, Samuel H.; Keyfitz, Nathan; and Schoen, Robert **(S-9-ZZ-64)**

Causes of Death: Life Tables for National Populations, Chapter III: Accuracy and Comparability

Seminar Press, New York and London, 1972

This book presents mortality data from 180 populations representing 48 nations by age and sex for all years from 1861 to 1964 for which both (1) numbers of deaths by cause, age, and sex, and (2) numbers of persons alive by age and sex were available. The authors discuss classification of cause of death and derive life-table parameters. In Section IIIB the authors compare mortality statistics by country and point out specific problems associated with different cause-of-death categories. Their treatment focuses on the declining proportions of deaths assigned to ill-defined and unknown causes, and the consequent increased proportion of assignment to well-defined diseases. However, the ill-defined classification still accounts for a large proportion of deaths in statistically poor countries. These phenomena made comparison between countries and comparisons over time difficult. The authors also summarize the major problems of accuracy and comparability for each major disease category.

95. Puffer, Ruth Rice **(ABCD-9-ZZ-64)**

Study of Multiple Causes of Death

Pan American Health Organization Report, Unpublished

In analyzing the data from the Inter-American Investigation of Mortality, death certificates, autopsy reports, and clinical records were compared for all (3,506) study deaths from San Francisco, California and Bristol, England for which clinical and autopsy records were available. (For further description of the study, see No. 96 in this report.)

In San Francisco, 94.0 percent of the underlying causes of death on the death certificate were considered present on autopsy, 4.8 percent were not stated on the autopsy report but were given on clinical records, and 1.2 percent were not present on either autopsy or clinical records. The percentages for Bristol were 81.9, 9.2 and 8.9, respectively.

The underlying cause stated on the death certificate was also compared with the final assignment of cause based on all available information collected in the investigation. The final assignment of cause was not given on the death certificate for 12.5 percent of the Bristol deaths and 7.9 percent of the San Francisco deaths. All comparisons were based on 232 groups of causes of death; that is, the underlying cause on the certificate was considered confirmed if the cause of death was finally assigned to any cause in the same group.

96. Puffer, Ruth Rice and Griffith, G. Wynne **(ABCD-9-ZZ-64)**

Patterns of Urban Mortality – Report of the Inter-American Investigation of Mortality: Chapter XV, Changes in Assignments of Causes of Death

PAN AMERICAN HEALTH ORGANIZATION, SCIENTIFIC PUBLICATION No. 151, 1967

In the Pan American Health Organization study of geographic variations in mortality, 12 cities in the United States, Central and South America, and the United Kingdom were selected for investigation. A systematic sample of deaths from the death registry in the age group 15-74 years was selected in each city for further study. The final sample included 43,298 deaths that occurred during 1962-64. Additional information was collected on clinical examinations, X-rays, laboratory examinations, biopsies, autopsies, and household interviews. The assembled histories were reviewed and recoded as to cause, thereby providing a measure of the reliability that can be attached to death certificate information. The 3,865 deaths in San Francisco and the 4,262 deaths in Bristol are most relevant to mortality statistics in the United States. Using a broad grouping of 74 causes, 26 percent of the deaths in San Francisco and 22 percent in Bristol showed a change in classification with the more definite information. For total respiratory disease cases in Bristol per 100 final assignments, 36 percent were excluded and 33 percent added. Over all 12 cities, 41 of every 100 final assignments to diseases of the digestive system were not originally in the same division of the 74-cause list; 23 of the 41 were transfers from other digestive diseases; 18 were transfers from outside the digestive disease group. The same type of result is presented for cardiovascular diseases, infective and parasitic diseases, maternal causes, malignant neoplasms, accidents and violence, and all other causes.

The authors conclude that medical certification can be improved and point out the desirability of devising record linkages to insure the use of available hospital and autopsy information.

97. Puffer, Ruth Rice and Serrano, Carlos V. **(ABCD-9-ZZ-71)**

Patterns of Mortality in Childhood–Report of the Inter-American Investigation of Mortality in Childhood: Chapter XVII, Changes in Assignments of Causes of Death

PAN AMERICAN HEALTH ORGANIZATION, SCIENTIFIC PUBLICATION No. 262, 1973

The PAHO Inter-American Investigation of Mortality in Childhood, in which 35,095 deaths of children under 5 years of age were studied, was conducted in 15 areas of North, Central, and South America. The objective was to establish death rates for these areas that would be as accurate and comparable as possible, taking into account biological as well as nutritional, sociological, and environmental factors. The investigation was conducted in Latin America in 1969-71, in California during 1969-70, and in Quebec Province, Canada during 1970-71. Data from household interviews, clinical records, death certificates, and autopsy records were studied to determine the true cause and circumstances of death. Clinical and other information in addition to the death certificate was available for 27,082 deaths from 14 projects. For slightly more than one-half of the deaths (52.5 percent) the final assignment of underlying cause was in agreement with the underlying cause derived from the death certificate. In nearly one-third of the deaths the underlying cause assigned on the death certificate was considered an associated cause on final assignment. Agreement rates are shown by project and by age at death. For a common communicable disease of childhood such as measles, only 55.4 percent of the deaths could have been known from death certificates, and in several projects the numbers of measle cases were more than doubled in the final assignment. Specific types of nutritional deficiency were also missed; a fivefold increase was noted for the more severe form, kwashiorkor.

98. Quinn, Robert W.; Sprague, Homer A.; and Quinn, Julia P. (ACD-3-US-65)

Mortality Rates for Rheumatic Fever and Rheumatic Heart Disease, 1940-65

PUBLIC HEALTH REPORTS 85(12):1091-1101, 1970

Over the period 1940-65, death rates due to rheumatic fever (RF) and rheumatic heart disease (RHD) decreased markedly. To determine if the trend was real or artificial, all deaths due to RHD and RF during the years 1940-65 in Nashville and Davidson County, Tennessee were selected for study. The underlying cause of death was determined by the ICD fifth revision for 1940-48, the sixth revision for 1949-58, and the seventh revision for 1959-65. Autopsy results and clinical records were obtained whenever possible, and after comprehensive evaluation of all available information, each underlying cause was either verified or reclassified. Only 61 percent of the causes of death due to RF or RHD were validated. The authors computed new death rates using the validated data rates and found only a slight decreasing trend during the period. Age, sex, and race differences in the rates were shown to diminish. The authors conclude that the downward trend in the RF and RHD death rates was an artificial decline brought about by the ICD changes in assignment of the underlying cause of death and by better diagnostic procedures for RF and RHD.

99. Ransom, Don (DS-9-US-75)

Quality and Accuracy of Vital Statistics at the Oklahoma State Department of Health

Unpublished paper

A discussion of the procedures for coding and validating vital records in Oklahoma is presented, along with estimated error rates for cause of death codes and several demographic items on the vital records.

100. Reid, D. D. and Rose, G. A. (ACD-9-ZZ-58)

Assessing the Comparability of Mortality Statistics

BRITISH MEDICAL JOURNAL 2:1437-1439, 1964

The reported death rates from coronary disease and bronchitis of middle-aged men are quite different for the United States, the United Kingdom, and Norway. The authors proposed and pretested a method of determining to what extent the mortality data only reflect international differences in diagnostic habits and concepts about the classification of various forms of cardiorespiratory disorder. Ten deaths were randomly selected from all deaths in two London hospitals in 1958 of males 40-64 years of age where death was certified as being due to one of a number of cardiovascular, renal, and respiratory diseases. All relevant clinical and autopsy information was abstracted and sent to doctors in Boston (24 doctors), Norway (16), and the United Kingdom (30) who determined the causes of death. Returns were then coded according to the ICD at the General Register Office in London. The classification of the cases into five broad categories was very close; however, within these groups, patterns of classifying deaths appeared which were in line with the pattern of prevailing mortality rates from these diseases in the three countries.

101. Riccitelli, M. L. (S-3-US-99)

Myocardial Disease in the Aged, Including a Review of the Literature

JOURNAL OF THE AMERICAN GERIATICS SOCIETY 14(4):366-379, 1966

The author discusses the problems of measuring the frequency of clinical myocarditis in the living population and notes that even the pathologist is unable to make this diagnosis without histological examination of the gross specimen. Data are presented from literature showing diseases associated with myocarditis and the types of lesions found. Diagnosis, treatment, and prognosis of myocarditis are summarized.

The author concludes that the literature review indicates that myocarditis occurs more frequently than clinicians realize, and it is associated with a wide variety of diseases, and that the diagnosis of myocarditis is seldom entered on either a hospital chart or a death certificate.

102. Rigdon, R. H. and Kirchoff, Helen (AD-9-US-61)

Vital Statistics and the Frequency of Disease

TEXAS STATE JOURNAL OF MEDICINE 59: 317-324, 1963

To examine the accuracy of cause of death statistics the authors selected 294 autopsy records for study; 100 cases routinely reviewed by the senior

author during 1959-61 in a general teaching hospital in Galveston and 194 cases of malignancies from the autopsy records made between 1945 and 1958 from a Houston hospital which treats only malignancies. The clinical diagnosis, the diagnosis coded for vital statistics, and the post-mortem diagnosis were compared for those 294 cases. For 20 percent of the cancer cases and 32 percent of the general hospital cases, the diagnoses coded for vital statistics were different from the death certificate or post-mortem diagnoses. Lack of information or errors in filling out the death certificate produced many of the discrepancies. The authors conclude that the frequency of diseases as shown by vital statistics, at best, is only a crude index of the frequency of disease.

103. Rose, Geoffrey **(S-3-UK-64)**

Errors in the Classification of Fatal Pericarditis

THE LANCET II: 851, 1966

The death rates for rheumatic fever and active rheumatic pericarditis in young people have declined rapidly in the period 1950-64. For adults a similar, but less rapid, decline has been observed for rheumatic fever. However, the death rate for active rheumatic pericarditis in adults has remained constant.

The author believes that deaths in adults currently classified as acute rheumatic pericarditis (ICD 401.0) are probably not rheumatic. The confusion may result from including in this category acute pericarditis, not otherwise specified. It is recommended that, in future revisions of the ICD, such deaths should be coded separately because they may be responsible for as much as a threefold inflation of the total mortality attributed to rheumatic fever.

104. Rosenblatt, Milton B.; Teng, Peter K.; and Kerpe, Stase **(AC-2-US-71)**

Diagnostic Accuracy in Cancer as Determined by Post Mortem Examination

PROGRESS IN CLINICAL CANCER 5:71-81, 1973

A comparison of clinical and post-mortem diagnoses was made for all patients (1,000) autopsied in Doctors' Hospital in New York during the period January 1, 1960 through February 6, 1971. During this period, there were 1,216 cases with clinical diagnoses of malignant disease and 493 cases with autopsy diagnoses of malignancy. The overall autopsy rate was 36 percent. For the common neoplasms defined clinically, most of the diagnoses were confirmed by autopsy (95-100 percent), except for carcinoma of the pancreas (80 percent) and for lung cancer where less than half of the cases were confirmed by autopsy. While the confirmation rate was high for most clinically detected carcinomas, the specific site of origin had been missed in a considerable number of cases. Between one-third and one-half of the carcinomas of the colon, pancreas, stomach, and ovary detected at autopsy were not suspected during life. Particular problems in the clinical diagnosis of primary lung cancer were discussed, explaining the marked disparity between cases established clinically and those found at autopsy.

105. Rosenblatt, Milton B.; Teng, Peter K.; Kerpe, Stase; and Beck, Irene **(AC-9-US-71)**

Causes of Death in 1,000 Consecutive Autopsies

NEW YORK STATE JOURNAL OF MEDICINE 71: 2189-2193, 1971

One thousand consecutive autopsies conducted at Doctor's Hospital in New York from January 1, 1960 through February 6, 1971 were studied to obtain a more accurate perspective on the current causes of death than that generally obtained from clinical data. Autopsy confirmation of 493 clinically diagnosed neoplasms ranged between 80 and 100 percent for carcinomas of the colon, breast, pancreas, stomach, and ovary, but many additional cases were diagnosed at autopsy which had not been suspected clinically. Carcinoma of the lung was the only neoplasm that was greatly overdiagnosed clinically, and no unsuspected cases were found at autopsy. The distribution of autopsy diagnoses for the remaining 507 patients with nonmalignant causes of death is presented.

106. Ross, Olivia and Kreitman, Norman **(DS-7-UK-99)**

A Further Investigation of Differences in the Suicide Rates of England and Wales and of Scotland

BRITISH JOURNAL OF PSYCHIATRY 127:575-582, 1975

(Author's summary) "National samples of case records of suicidal-type deaths from England and Wales and from Scotland were reassessed by officials in the other country. It emerged that similar criteria for suicide existed in both countries, and that there was no age-related tendency to misclassify cases. The lower official suicide rate amongst the old in Scotland

was therefore considered not to result from ascertainment differences. It was also concluded that Scottish records were not so briefly documented as to prevent the conclusive ascertainment of cause by England and Wales coroners. Cases which were designated 'undetermined' in Scotland tended to be classified 'accidental' by coroners. Reasons for the lower incidence of suicide in Scotland are discussed."

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107. Rossman, Isadore **(DS-3-US-73)**

True Incidence of Pulmonary Embolization and Vital Statistics

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 230(12):1677-1679, 1974

To examine the discrepancy between autopsy incidence and vital statistics reporting of fatal pulmonary embolization, all of the coded New York City death certificates for April 1973 (6,385) were selected for study. Pulmonary embolus was listed as a major or contributing cause on 207 death certificates. Of the 182 deaths in which death was ascribed directly to pulmonary embolus, only one-sixth was coded to this cause for vital statistics purposes. The remaining cases were coded most often to cancer, chronic heart disease, and acute myocardial infarct. Furthermore, there is substantial evidence from past studies that pulmonary embolization is clinically unrecognized and, therefore, underreported as a cause of death in the absence of autopsy.

108. Rossman, Isadore; Rothstein, Manuel; and Bornstein, Alfred **(AC-9-US-71)**

Undiagnosed Diseases in an Aging Population: Pulmonary Embolism and Bronchopneumonia

ARCHIVES OF INTERNAL MEDICINE 133:366-369, 1974

To study the accuracy of cause-of-death statements for the elderly, chronically ill, institutionalized population, a study was conducted of 250 consecutively autopsied patients who died between 1966 and 1971 in the Kingsbridge Division of the Jewish Home and Hospital for Aged (JHHA). Comparisons are made between the autopsy and clinical diagnoses with emphasis on primary cause of death, associated conditions, and premortem diagnoses. Accuracy of diagnosis was highest for ischemic heart disease and for cerebral vascular accidents (both 100 percent) and lowest for pulmonary embolism. The six chief causes of death in the JHHA group were contrasted with those in a comparison group, all over 80 years of age who were autopsied in New York City general hospitals in 1970. The JHHA group showed death rates of 22.8 percent for bronchopneumonia and 6.4 percent for pulmonary embolism, compared with rates of 8 percent and 2 percent, respectively, for these conditions in the general hospital group. Comments are included on the diagnosis and treatment of these two conditions.

109. Samuelson, Wayne M.; Williams, Roger R.; and Maness, A. Timothy **(CD-3-US-75)**

Accuracy of Death Certificates in Utah for Myocardial Infarction

University of Utah College of Medicine, 1979, Unpublished

(Author's abstract) "From a computer file of 37,387 Utah deaths attributed to myocardial infarction during the years 1956-1975, a sample of 387 in-hospital deaths were assessed for verification of the death certificate diagnosis. Hospital charts were reviewed for 387 persons who died in 32 Utah hospitals during 1956-1975 and whose death certificates listed acute myocardial infarction as the underlying cause of death. Charts were rated according to objective data present, and a composite 'verification score' was used to test for differences between subgroups.

"Objective data in hospital charts supported the diagnosis of MI for 81 percent of the corresponding death certificates. Deaths attributed to myocardial infarction were better supported in males than in females, in larger hospitals than in smaller hospitals, and in the years 1966-1975 than in the years 1956-1965. Somewhat better verification was observed among younger MI deaths, but this difference lacked statistical significance."

110. Sauer, Herbert, I. **(S-9-US-72)**

Cause Specific Death Rates as a Measure of Need

Presented at the National Center for Health Statistics Data Use Conference, Dallas, Texas, March 1977, Unpublished

(Author's summary) "Individuals in various settings have a tendency to draw conclusions from data as if the data collection, tabulation and analysis were done perfectly, or else go to the other extreme of assuming data to be worthless. Each extreme is usually an untenable position. When any of the

categories containing ill-defined deaths (especially 'Symptoms and ill-defined, ICDA 780-796,' 'Other heart disease, ICDA 420-429,' 'Malignant neoplasm, site secondary or unspecified, ICDA 195-199,' and 'Neoplasm, benign or not specified ICDA 210-239') is substantially in excess of the U.S. rate, then it is appropriate to question whether the counts for specific causes are reasonably complete. When the rates for these ill-defined (or 'wastebasket') categories are low, there is less opportunity for specific cause categories/rates to be incomplete.

"Specific cause categories may also be incomplete because, in a specific area, there may be a tendency to give greater weight to the role of one cause, and in another area to give more weight to another cause. Available evidence suggests that generally these shortcomings do not present serious limitations in the data. However, it seems both feasible and desirable, before using death data, to consider the evidence in support of a hypothesis of limited data accuracy.

"The count of the number of deaths and crude (all ages) death rates have value for program planning and evaluation, even when they are a function of the age distribution of the population. For more intensive planning and evaluation purposes, age-sex-race-specific death rates for chronic diseases are also likely to be needed."

111. Sauer, Herbert I. and Enterline, Philip E. **(S-3-US-51)**

Are Geographic Variations in Death Rates for the Cardiovascular Diseases Real?

JOURNAL OF CHRONIC DISEASES 10(6):513-524, 1959

The authors present 1949-51 United States mortality data by State for white males aged 45-64 years for all causes and for cardiovascular diseases. Various aspects of death rates are analyzed, including the magnitude of differences between States, the correlation between the death rates and physician supply, and the correlation between cardiovascular and non-cardiovascular disease death rates and between coronary and other cardiovascular disease death rates. The authors conclude that considerable geographic differences do exist between States.

112. Schoenberg, Bruce S. and Powell, James Meyers, Jr. **(CD-4-US-65)**

Statistics on Stroke: A Pilot Study of the Clinical Evidence Justifying the Reporting of Stroke on Death Certificates in Alameda County, California

CALIFORNIA MEDICINE 109(1):19-23, 1968

In April 1965, 94 certificates of death in Alameda County had stroke (rubrics 330-334) listed as the immediate, contributory, or underlying cause of death. Because of the necessity for accurate information in a short period of time concerning those deaths, only patients who died in hospitals or nursing homes and who had clinical records present were further studied. Each case was matched to a control death on the basis of age, sex, race, and place of death. Controls were chosen from the deaths classified to the rubric 420-459, because it was felt that most patients with missed diagnoses would be in this category. Twenty-two percent (11) of the hospital deaths that had no mention of stroke on the certificate were found to have had a stroke by the authors' criteria (false negative), while 20 percent (3) of the control group's nursing home deaths were false negatives. The false-positive percent of the nursing home cases (47 percent), on the other hand, was much higher than the false-positive percent for the cases who died in hospitals (2 percent). False positives were defined as cases where the clinical data failed to support the death certificate diagnosis of stroke. It was concluded that if immediate and contributory causes of death were included in the death rate tabulations, then the resulting stroke rates would be higher and might reflect more accurately the true experience of stroke cases in the United States.

113. Schwartz, Charles J. **(CD-9-US-74)**

The Hawaii Mortality Follow-back Study: 2. An Evaluation of Medical Certification of the Cause of Death Through the Use of Hospital Discharge Diagnoses

HAWAII STATE DEPARTMENT, R AND S REPORT ISSUE NO. 17, RESEARCH AND STATISTICS OFFICE, 1977

As part of the Hawaii followback study, estimates were made of the errors in certified causes of death.

(See Number 19 in this report.) The study included 715 deaths of Oahu residents dying in Honolulu from February 1972 through January 1974 for whom a hospital record was available. Deaths due to homicide, suicide, accidents, or cancer were excluded. Using the hospital diagnosis as the standard, the author computed the error rates of death certificate classification. Significant differences were found between the two cause-of-death classifications, the largest errors being in the categories of hypertension and hypertensive disease, chronic ischemic heart disease, and other heart disease. The gross error in classification of cause of death on the death certificate was computed to be 20 percent. Agreement of the death certificate diagnosis with the hospital diagnosis varied considerably by disease. Reliability rates for various classifications were derived and possible sources of error were identified.

114. Shipley, Paul W.; Norris, Frank D.; Wray, Jo Ann; Alberton, Paul G.; and De Fisher, Duke **(BD-9-US-62)**

Final Report of California Medical Certification of Death Study

California Department of Public Health, 1964, final grant report, Unpublished.

In developing protocols for a cause-of-death validation study, two projects were carried out; (1) California death certificates for the years 1952 and 1962 were studied, and (2) a pretest was conducted with 42 physicians concerning their understanding of certification procedures.

The death certificate study yielded data on the following topics: autopsy rates, characteristics of autopsied cases, characteristics of the certifier, extent of use of coding rules in selecting underlying cause, apparent changes in coding cardiovascular renal disease by the Los Angeles County Coroner's Office, and the use of affidavits to correct medical information on the death certificate.

The pretest interviews conducted with 29 physicians in the bay area and 13 physicians in Los Angeles County covered such topics as the physician's understanding of the concepts and procedures involved in completing death certificates, his background and training, and suggestions on instructional material that would be useful. Physicians reported considerable difficulty with the sequential aspect of the cause-of-death statement and preferred simply to list significant conditions present at death. A need was indicated for standardized instruction in filling out death certificates.

115. Skyring, A.; Modan, B.; Crocetti, A.; and Hammerstrom, C. **(ACD-3-US-57)**

Some Epidemiological and Familial Aspects of Coronary Heart Disease: Report of a Pilot Study

JOURNAL OF CHRONIC DISEASES 16:1267-1279, 1963

A list of all deaths of persons under 46 years of age classified as caused by arteriosclerotic heart disease, chronic endocarditis not specified as rheumatic and myocardial degeneration (International Statistical Classification of Causes of Death Rubric Nos. 420, 421, and 422, respectively) for the years 1954-57 was obtained from the Baltimore City Health Department. Death certificates were obtained and an attempt was made to verify the cause-of-death statement by a review of hospital records, autopsy records in hospitals and in medical examiners' offices and private physicians' records. Criteria were specified for classifying the deaths as proved cases of coronary occlusion and myocardial infarction, unproved but probable cases, and definitely not coronary occlusion, myocardial infarction, or both.

A table is presented showing that 16 of 324 deaths ascribed to arteriosclerotic heart disease were not coronary artery disease. None of the nine deaths certified as chronic endocarditis not specified as rheumatic were proved or probable cases of coronary heart disease, but 26 of the 80 deaths certified as resulting from myocardial degeneration definitely had coronary heart disease and an additional 18 were designated as probable.

The authors suggest that the latter findings indicate the need for searching this category for deaths from myocardial infarction in future studies.

116. Spain, David M.; Bradess, Victoria A.; and Mohr, Charles **(A-9-US-59)**

Coronary Atherosclerosis as a Cause of Unexpected and Unexplained Death: An Autopsy Study from 1949-1959

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 174(4):384-388, 1960

All autopsies of persons over 30 years of age performed between 1949 and 1959 in Westchester County, New York, were studied to determine the frequency with which coronary atherosclerotic heart disease appeared as a cause of sudden unexplained and unexpected death in adults. These 1,329 deaths

were classified into three groups according to the duration of the fatal episode: (1) less than 1 hour, (2) between 1 and 3 hours, and (3) duration unknown (unwitnessed). Coronary atherosclerotic heart disease was the cause of death for 91 percent of the 463 white males and for 48 percent of the white females in group one. For the unwitnessed deaths (group 3), 61 percent of the white males and 35 percent of the white females died from coronary artery disease. The frequency of spontaneous intracerebral or subarachnoid hemorrhage as cause of death was also studied. The author points out that assignment of a cause of death without an autopsy in cases of sudden unexplained or unexpected deaths in adults can seriously distort the vital statistics.

117. **Steer, Arthur; Land, Charles E.; Moriyama, Iwao M.; Yamamoto, Tsutomu; Asano, Masahide; and Sanefuji, Hayato** **(AD-9-JP-70)**

Accuracy of Diagnosis of Cancer Among Autopsy Cases: JNIH–ABCC Population for Hiroshima and Nagasaki

GANN JOURNAL 67(5):625-632, 1976

(Author's abstract) "The accuracy of death certificate diagnoses of cancer in the fixed population of about 100,000 samples in Hiroshima and Nagasaki was determined for the period 1961-1970 by comparison with autopsy findings. In general, when the death certificate listed cancer as a cause of death it was found at autopsy in a high proportion of cases. However, cancer was not always reported on death certificates, indicating that cancer occurs more frequently than recorded by official mortality statistics. Older persons, persons who die at home, and persons with certain cancers are more likely not to have cancer named on their death certificates. It is estimated that in the 10,749 deaths occurring at home or in hospital, there were 32 percent more deaths due to cancer than certified on death certificates (3,095 vs. 2,345) and for persons aged 70 or more dying at home it is estimated there were 55 percent more stomach cancer (269 estimated vs. 174 listed) and 244 percent more lung cancer (141 estimated vs. 41 listed) than were certified on death certificates.

"The death certificate is not a good source of information for cancer of the cervix because many cases of this disease are reported on death certificates as cancer of the uterus. This practice needs to be taken into account in the use of mortality data for cervical cancer in Japan."

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118. **Steinitz, Ruth and Costin, Corina** **(BD-2-IS-65)**

Cancer Mortality - Vital Statistics Versus Cancer Registry

ISRAEL JOURNAL OF MEDICAL SCIENCES 7(12): 1405-1412, 1971

Epidemiological conclusions about cancer mortality among Israel's Jewish population have been based on death certificate data supplied by the Central Bureau of Statistics (CBS). To see whether these conclusions would be different if the CBS data were checked against data from the Israel Cancer Registry (ICR), standardized cancer mortality rates for Jews dying in 1964-65 were computed by site and sex from ICR data and compared with rates based on CBS data published for the same time period. Frequency distributions by age and site are also compared for the two data sources. Observed differences and possible explanations for the differences are discussed briefly.

119. **Virkkunen, M.; Penttilä, A.; Tenhu, M.; Huittinen, V.-M.; Lehti, H.; Rissanen, V.; and Uotila, U.** **(ABC-9-FN-99)**

Comparative Study on the Underlying Cause and Mode of Death Established Prior to and After Medicolegal Autopsy

FORENSIC SCIENCE 5(1):73-79, 1975

To investigate the value of external medicolegal examination of decedents as an alternative to medicolegal autopsy, 600 selected cases on which a medicolegal autopsy had been performed in the city of Helsinki were studied. Six physicians of the Department of Forensic Medicine reviewed all information that had been available for these cases before autopsy and assigned causes of death according to the Eighth Revision ICD, and modes of death according to the international rules of deaths from natural causes, accidents, suicides, homicides, and deaths in which the mode could not be determined. Comparison of the cause and mode of death with those established after medicolegal autopsy revealed that the mode of death differed in 60 cases, primarily in the groups of accidental deaths, suicides, and natural deaths. The underlying cause of death diverged in about 29.5 percent of the 600 cases. For deaths from natural causes, the cause of death was misclassified most

often in deaths due to subarachnoidal hemorrhage, cerebral hemorrhage, or malignant tumors. For violent deaths, misclassification occurred most often when death was due to the toxic effects of drugs or alcohol. The authors conclude that the medicolegal autopsy can significantly improve the accuracy of assignment of the underlying cause of death.

120. Waaler, Erik and Grimstvedt, Magne (AC-2-NW-54)

The Clinical Diagnoses of the Causes of Death and Their Reliability

ACTA PATHOLOGICA ET MICROBIOLOGICA SCANDINAVICA 43(4):330-338, 1958

The authors compared autopsy and clinical findings for the 783 malignancy deaths in Bergen, Norway for the period 1950 through 1954. Using the autopsy findings as definitive, premortem clinical diagnoses were classified as correct (63 percent), doubtful (10 percent), and wrong (19 percent). In 6 percent the malignant tumors were an incidental finding not related to the cause of death and in 13 cases (1.6 percent) the primary tumor could not be found with certainty at the post-mortem examination. The autopsy rate for malignancy cases in Bergen was 30 percent during the period. Carcinomas of the breast, cervix and corpus of the uterus, and leukemias were virtually all correct (97-100 percent), while the percent for less accessible tumors ranged from 0 percent for papilla of vater and duodenum and 13 percent for liver to 60 percent for colon and 62 percent for stomach.

121. Waldron, H. A. and Vickerstaff, Lorna (ACD-9-UK-76)

Intimations of Quality: Ante-Mortem and Post-Mortem Diagnoses

Nuffield Provincial Hospitals Trust, London, 1977

To examine the degree of agreement between the ante mortem and post mortem causes of death, a prospective study modeled on the Heasman and Lipworth study was carried out in the West Midlands and the Trent regions. Hospitals in these regions were sent two-part forms; the first was to indicate the clinician's diagnosis prior to autopsy, and the second was to reflect the cause of death determined by the pathologist, based on both autopsy results and discussion with the clinician. All deaths autopsied in the participating hospitals from January 1975 through April 1976 were included in the study.

Of the 1,117 cases for which both ante mortem and post mortem diagnoses were available, 531 (47.5 percent) showed complete agreement between the clinical diagnosis and autopsy diagnosis, 295 (26.4 percent) showed partial agreement, and 291 (26.1 percent) indicated disagreement between the clinical and autopsy diagnoses. Disagreements were more likely for females, the elderly, nonteaching-hospital patients, those with a clinical diagnosis of respiratory disease, and those in which the clinical diagnosis was uncertain.

122. Walford, P. A. (CD-3-UK-99)

Sudden Death in Coronary Thrombosis: A Study of the Accuracy of Death Certification

JOURNAL OF THE ROYAL COLLEGE OF GENERAL PRACTITIONERS 21:654-656, 1971

Eleven general practitioners supplied information on all cases (142 total) encountered in their practices of sudden deaths classified as due to coronary thrombosis. They were asked to give the bases for the final diagnoses and to rate the certainty of the diagnoses. In 57 of the 142 cases, there was no ante mortem evidence of coronary disease and no necropsy had been performed. The author concludes that general practitioners are introducing into mortality statistics a considerable though unquantifiable error.

123. Walsh, Brendan; Walsh, Dermot; and Whelan, Brendan (B-7-IR-68)

Suicide in Dublin: II. The Influence of Some Social and Medical Factors on Coroners' Verdicts

BRITISH JOURNAL OF PSYCHIATRY 126:309-312, 1975

(Author's summary) "This paper presents an analysis of the factors which influence coroners in their decision to classify some deaths as suicides and others as accidental or 'open'. The most important influence on coroners' behavior was seen to be the manner by which the person died. Those who died by cutting, hanging, drugs or gas were significantly more likely to receive a suicide verdict than those whose deaths were due to drowning, jumping, shooting, or poisoning. If the deceased left any intimation of a suicidal intent, this increased the likelihood that a suicide verdict would be returned. Finally, persons aged under 40 were significantly more likely to be returned as suicides than older victims, especially those aged over 70. All of these results show that coroners operate by observing the law as it defines

suicide, that is, by looking for evidence of intent of self-inflicted death.

"Our findings concerning the factors associated with the suicide verdict help to clarify the meaning of the official data on suicides in Ireland, and illuminate the reasons why, using clinical rather than legal criteria, a much higher rate is obtained."

NOTE: The study was based on 201 coroners' cases in Dublin during 1964-68 which were judged to be suicides in a previous study. (See Number 76 in this report.)

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124. **Warshauer, M. Ellen and Monk, Mary** **(BDS-7-US-70)**

Problems in Suicide Statistics for Whites and Blacks

AMERICAN JOURNAL OF PUBLIC HEALTH 68(4):383-388, 1978

(Author's abstract) "The accuracy of suicide statistics was assessed by comparing published Health Department suicide rates for an area of New York City with Medical Examiner records. For the period 1968-1970, records from the Medical Examiner's Office were searched to determine all deaths classified as definite suicides. Another group of deaths was considered suicide by the Medical Examiner but never classified as such. These deaths we labeled 'assigned suicides'.

"When definite suicides were compared with all deaths considered suicide by the Medical Examiner (definite and assigned suicides), black suicide was underestimated by 80 percent and white suicide by 42 percent. Underestimation was the same for males and females but varied by age group.

"In 1968, when the seventh revision of the International Classification of Deaths (ICD) was used, Health Department suicide rates for blacks were almost identical to Medical Examiner rates, while white rates were underestimated by 25 percent. In 1969-1970, when the eighth revision was used, Health Department statistics underestimated black suicides by 82 percent and white suicides by 66 percent.

"Reasons for the underestimations were related to the methods used in committing suicide by the two ethnic groups and to the ways that suicide classification has changed from the seventh to eighth revision. Implications for research using official death certificate reports are discussed."

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125. **Weiss, Noel S.; Green, Delray; and Krueger, Dean E.** **(DS-8-US-68)**

Problems in the Use of Death Certificates to Identify Sudden Unexpected Infant Deaths

HEALTH SERVICES REPORTS 88(6):555-558, 1973

(Author's abstract) "Death certificates on all U.S. infants who died at 3 months of age in 1968 were examined to see if sufficient information was available to identify those whose death was sudden and unexpected. Of the 2,954 deaths, 371 were coded for official mortality statistics on underlying cause of death to nonspecific causes implying, or compatible with, sudden unexpected death (ICDA eighth revision, 795, 796.2, 796.3, 796.9). An additional 151 deaths were described on the death certificate as sudden and unexpected, but because of the presence of other information in the cause of death section, they were assigned to various specific causes of death. Based on incidence rates from several earlier studies, it was estimated that there remained at least several hundred additional sudden unexpected infant deaths coded to other causes. Nonetheless, other items that might have been helpful in identifying these deaths, such as approximate interval between onset and death, place of death, and type of certifier, were either infrequently recorded or not sufficiently discriminating to establish criteria for sudden unexpected death that were both sensitive and specific.

"Unless changes are made in the construction of the death certificate, the completeness and accuracy with which it is filled out, or the coding of underlying cause of death, it is unlikely that accurate rates of sudden unexpected infant death will be routinely produced in the United States."

126. Wilson, Robert R. (AC-9-UK-58)

In Defense of the Autopsy

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 196(11):1011-1012, 1966

To assess the usefulness of autopsies, the clinical diagnosis was compared with the post mortem diagnosis for 265 adult decedents (excluding cases "brought in dead") autopsied in 1958 in Paddington General Hospital, London. Using the post mortem diagnosis as the standard, the author found that the clinical diagnosis was absolutely correct in 53 percent of the cases, partly correct in 40 percent, and totally wrong in 7 percent.

127. Worth, R. M.; Kato, H.; Rhoads, G. G.; Kagan, A.; and Syme, S. L. (ACD-9-ZZ-72)

Epidemiologic Studies of Coronary Heart Disease and Stroke in Japanese Men Living in Japan, Hawaii and California: Mortality

AMERICAN JOURNAL OF EPIDEMIOLOGY 102(6):481-490, 1975

(Author's abstract) "Stroke, coronary heart disease (CHD) and total mortality are evaluated from death certificates in enumerated cohorts of 45-64-year-old Japanese men in Hiroshima and Nagasaki (1965-1970), in Honolulu (1966-1970), and in the San Francisco area (1968-1972). Total mortality is highest in Japan with no consistent differences between Japanese Americans in Honolulu and San Francisco. Age-specific CHD death rates are markedly lower in all three Japanese groups than in American whites. The CHD rates are consistently and significantly lower in Japan than in American Japanese. Stroke death rates for American Japanese men appear equivalent to figures for U.S. white men of the same age, but are significantly lower than in the Japan cohort for the 60-64-year-old group. The number of stroke deaths below that age are too few as yet for analysis. Validation of mortality ascertainment and of the accuracy of death certification had been carried out in Japan and in Hawaii. The international differences in mortality do not appear to be due to certification or other methodologic artifact."

NOTE: In Japan, comparison of the certified cause of death to autopsy findings for about one-third of the study group yielded estimates of 20 percent overreporting for CHD and 5 percent overreporting for stroke. In Honolulu, comparison of the certified cause of death with data from hospital records, the medical examiner's office, autopsy reports, and attending physicians yielded estimates of 22 percent overreporting of CHD deaths and 15 percent underreporting of stroke deaths.

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128. Wright, D. J. M. (CD-8-UK-66)

Inaccuracy and Under-Reporting in Certification of Death Following Urethral Stricture

MEDICINE, SCIENCE, AND THE LAW 9:205-207, 1969

In a comparison of death certificates and clinical case records, the author obtained from the General Register Office all 247 death records for the years 1964-66 pertaining to urethral stricture. Useful case notes were obtained for 165 of the 180 inhospital deaths. The underlying cause of death was misdiagnosed as urethral stricture in 12 percent of the 165 cases. Errors in assignment of the direct cause of death were found in 18 percent of the cases. Incompleteness of case notes was a serious problem: in a comparison with case notes for 85 current patients with urethral stricture at two teaching hospitals, the site and cause were recorded 20 percent less often in the case notes for the study sample. Using estimates by Caine (1954) and Dunlop (1961), the author concludes that over 90 percent of urethral strictures are unreported on the death certificate.

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